Draft Technical Report for Tentative Cleanup and Abatement

Order No. R9-2005-0126

For The Shipyard Sediment Site

San Diego Bay, San Diego, CA

CALIFORNIA
Water Boards

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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CLEANUP AND ABATEMENT ORDER
NO. R9-2005-0126

Adopted by the
California Regional Water Quality Control Board
San Diego Region
on _____________, 2007

Cover Photograph of San Diego Bay Shipyards by David T. Barker

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Table of Contents

Acronyms & Abbreviations

AET Apparent Effects Threshold

AFFF Aqueous Film Forming Foam

ASTM American Society of Testing Material

ANOVA Analysis of Variance

AQUA Aquaculture Beneficial Use

ARCO Atlantic Richfield Company

ASTs Aboveground Storage Tanks

AT & SF Atchison, Topeka, and Santa Fe Railroad

AVS/SEM Acid Volatile Sulfide / Simultaneously Extracted Metals

BAP Benzo[a]pyrene

Bight 98 Southern California Bight 1998 Regional Marine Monitoring Survey

BIOL Preservation of Biological Habitats of Special Significance

BMPs Best Management Practices

BPJ Best Professional Judgment

BRI-E Benthic Response Index for Embayments

BSAFs Biota-to-Sediment Accumulation Factors

BTAG U.S. Navy/U.S. EPA Region 9 Biological Technical Assistance Group

CCC Criterion Continuous Concentration

CCR California Code of Regulation

CEQA California Environmental Quality Act

CMC Criterion Maximum Concentration

CNRSW Commander Navy Region Southwest

COMM Commercial and Sport Fishing Beneficial Use

CSF Cancer Slope Factor

CTR California Toxics Rule

CWA Clean Water Act

CWC California Water Code

DFG California Department of Fish and Game

DRO Diesel Range Organics

DTSC California Department of Toxic Substances Control

DWQ Division of Water Quality

EC50 Median Effective Concentration

EMC Event Mean Concentration

EqP Equilibrium Partitioning Approach

ERL Effects Range Low

ERM Effects Range Medium

EST Estuarine Habitat Beneficial Use

FACs Fluorescent Aromatic Compounds

FSP Field Sampling Plan

GRO Gasoline Range Organics

HPAH High Molecular Weight Polynuclear Aromatic Hydrocarbons

HQ Hazard Quotient

IND Industrial Service Supply Beneficial Use

IR Ingestion Rate

IRIS Integrated Risk Information System

Kp Partition Coefficients

LAET Lowest Apparent Effects Threshold

LC50 Median Lethal Concentration

LOAELs Low-Adverse-Effects-Levels

LOE Lines of Evidence

LPAH Low Molecular Weight Polynuclear Aromatic Hydrocarbons

LPL Lower Prediction Limit

MAR Marine Habitat Beneficial Use

MARCO Marine Construction and Design Company

MEK Methyl Ethyl Ketone

MIGR Migration of Aquatic Organisms Beneficial Use

MS4 Municipal Separate Storm Sewer System

MTDB Metropolitan Transit Development Board

NASSCO National Steel and Shipbuilding Company

NAV	Navigation Beneficial Use
NAVSTA	Naval Station
NOAA	National Oceanic and Atmospheric Administration
NOAELs	No-Adverse-Effects-Levels
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRTAs	Natural Resource Trustees Agencies
NTR	National Toxics Rule
OHHEA	Office of Environmental Health and Hazard Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCTs	Polychlorinated Terphenyls
PL	Prediction Limit
PPPAH	Priority Pollutant Polynuclear Aromatic Hydrocarbon
PRGs	Preliminary Remediation Goals
PW	Pore Water
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
RAP	Remedial Action Plan
RARE	Rare, Threatened or Endangered Species Beneficial Use
REC1	Contact Water Recreation Beneficial Use
REC2	Non Contact Water Recreation Beneficial Use
RfD	Reference Dose
RLs	Response Levels
RME	Reasonable Maximum Exposure
RRO	Residual Range Organics
SCCWRP	Southern California Coastal Water Research Project
SDG&E	San Diego Gas and Electric
SDMC	San Diego Marine Construction Company
SDUPD	San Diego Unified Port District
SHELL	Shellfish Harvesting Beneficial Use
SQGs	Sediment Quality Guidelines
SQGQ	Sediment Quality Guideline Quotient
SVOCs	Semi Volatile Organic Compounds
S-W Diversity	Shannon-Weiner Diversity Index
SWI	Sediment Water Interface
SWM	Southwest Marine, Inc.
SWCS	Storm Water Conveyance System
SWPPP	Storm Water Pollution Prevention Plan
SWPMP	Storm Water Pollution Monitoring Plan
TBT	Tributyltin
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TR	Tissue Residue (biota-water-sediment equilibrium partitioning approach)
TRGs	Tissue Residue Guidelines
TRI	Toxic Release Inventory
Triad	Sediment Quality Triad
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
TUc	Toxic Unit Chronic
UPL	Upper Prediction Limit
U.S. EPA	U. S. Environmental Protection Agency
U.S. FWS	U. S. Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat Beneficial Use
WOE	Weight of Evidence

Preface

The Regional Board is considering development and issuance of a cleanup and abatement order for discharges of metals and other pollutant wastes to San Diego Bay marine sediment and waters. On April 29, 2005 the Regional Board circulated for public review and comment a tentative version of the cleanup and abatement order (see tentative Cleanup and Abatement Order No. R9-2005-0126. A copy of this document is posted on the Regional Board website at http://www.waterboards.ca.gov/sandiego.

Based on the Regional Board's consideration of public comments submitted on the April 29, 2005 draft Order and other information a revised tentative Cleanup and Abatement Order No. R9-2005-0126 dated ____________. Changes to the cleanup and abatement order have been marked in redline/strike out to facilitate review. A copy of the revised document is posted on the Regional Board website at http://www.waterboards.ca.gov/sandiego

This Technical Report provides the rationale and factual information supporting the findings of the revised Cleanup and Abatement Order No. R9-2006-0016. The text of each Cleanup and Abatement Order (CAO) finding is presented first followed by a summary of the rationale and factual evidence supporting the finding. A copy of the revised document is posted on the Regional Board website at http://www.waterboards.ca.gov/sandiego

1. Finding 1: Waste Discharge

Elevated levels of pollutants above San Diego Bay background conditions exist in the San Diego Bay bottom marine sediment along the eastern shore of central San Diego Bay in an area extending approximately from the Sampson Street Extension to the north and Chollas Creek to the south and from the within and adjacent to the National Steel and Shipbuilding Company Shipyard facility (hereinafter "NASSCO") and Southwest Marine, Inc hereinafter "Southwest Marine) the BAE Systems San Diego Ship Repair Facility (hereinafter "BAE Systems") shoreline out to the San Diego Bay main shipping channel to the west.leaseholds. This area is (hereinafter collectively referred to as the "Shipyard Sediment Site"). NASSCO, BAE Systems San Diego Ship Repair, Inc., City of San Diego, Marine Construction and Design Company and Campbell Industries, Inc., Chevron, a subsidiary of ChevronTexaco, BP as the parent company and successor to Atlantic Richfield Company, San Diego Gas and Electric, a subsidiary of Sempra Energy Company, and the United States Navy have each caused or permitted the discharge of pollutants to the Shipyard Sediment Site resulting in the accumulation of pollutants in the marine sediment. The contaminated marine sediment concentrations of these pollutants causes or threatens to cause conditions of pollution, contamination, and nuisance in San Diego Bay that adversely affects three categories of beneficial uses aquatic life, aquatic-dependent wildlife, and human health and San Diego Bay beneficial uses. A map of the Shipyard Sediment Site region is provided in Attachment 1 to this Order.

1.1 Shipyard Sediment Site

Discharges of metals and other pollutant[1] wastes to San Diego Bay marine sediment and water have resulted in the accumulation of pollutants in bay bottom marine sediment, which creates conditions that adversely impacts three categories of beneficial uses: aquatic life, aquatic-dependent wildlife, and human health. The sediment containing elevated levels of pollutants is referred to in this Technical Report as "contaminated marine sediment[2].

The contaminated marine sediment are located along the eastern shore of central San Diego Bay and encompass an area extending approximately from the Sampson Street Extension to the north and Chollas Creek to the south and from the National Steel and Shipbuilding Company Shipyard facility (NASSCO) and BAE Systems shipyard

[1] Any type of industrial, municipal, and agricultural waste discharged into water is a pollutant. The term *pollutant* is defined in Clean Water Act section 502(6) as dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, "chemical wastes", biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. The term *pollutant* has been further broadened by the NPDES regulations (40 CFR 122) and court cases.

[2] As used in this Technical Report, the term "contaminated marine sediment" is intended to refer to sediment that either meets the definition of "contamination" under Water Code section 13050(k) or that creates, or threatens to create, a condition of "pollution" under Water Code section 13050(l).

facilities shoreline out to the San Diego Bay main shipping channel on the west. This area is referred to by the term "Shipyard Sediment Site" in the Cleanup and Abatement Order and throughout this Technical Report

The NASSCO and BAE Systems San Diego shipyard facilities are located on the eastern shore of central San Diego Bay, approximately one half mile south of the Coronado Bridge and half the total distance into the Bay. The NASSCO and BAE Systems leaseholds are physically adjacent to each other, have a similar range of water depths, and lie within the same hydrologic and biogeographic area. The total combined San Diego Bay water acres included in the NASSCO and BAE Systems leaseholds is approximately 56 acres. The Shipyard Sediment Site encompasses the entire 56 water acres of the NASCCO and BAE Systems leaseholds. Also included in the Shipyard Sediment Site investigation were areas just outside the northern boundary of the BAE Systems leasehold and areas west of the Shipyard Sediment Site near the eastern edge of the shipping channel. The vertical and horizontal extent of the Shipyard Sediment Site includes bay bottom marine sediment with pollutant levels greater than "background conditions" [3] found in relatively "clean" regions of San Diego Bay and includes areas that extend beyond the NASSCO and BAE Systems leaseholds. A map of the Shipyard Sediment Site region is provided in Figure 1-1 below.

[3] The term background conditions as used in this Technical Report refers to sediment quality conditions found in areas of San Diego Bay that are remote from known pollution sources. A discussion of the factors considered in defining San Diego Bay background conditions for use in identifying areas at the Shipyard Sediment Site that may require remediation or cleanup is contained in Sections 15 and 31 of the Technical Report.

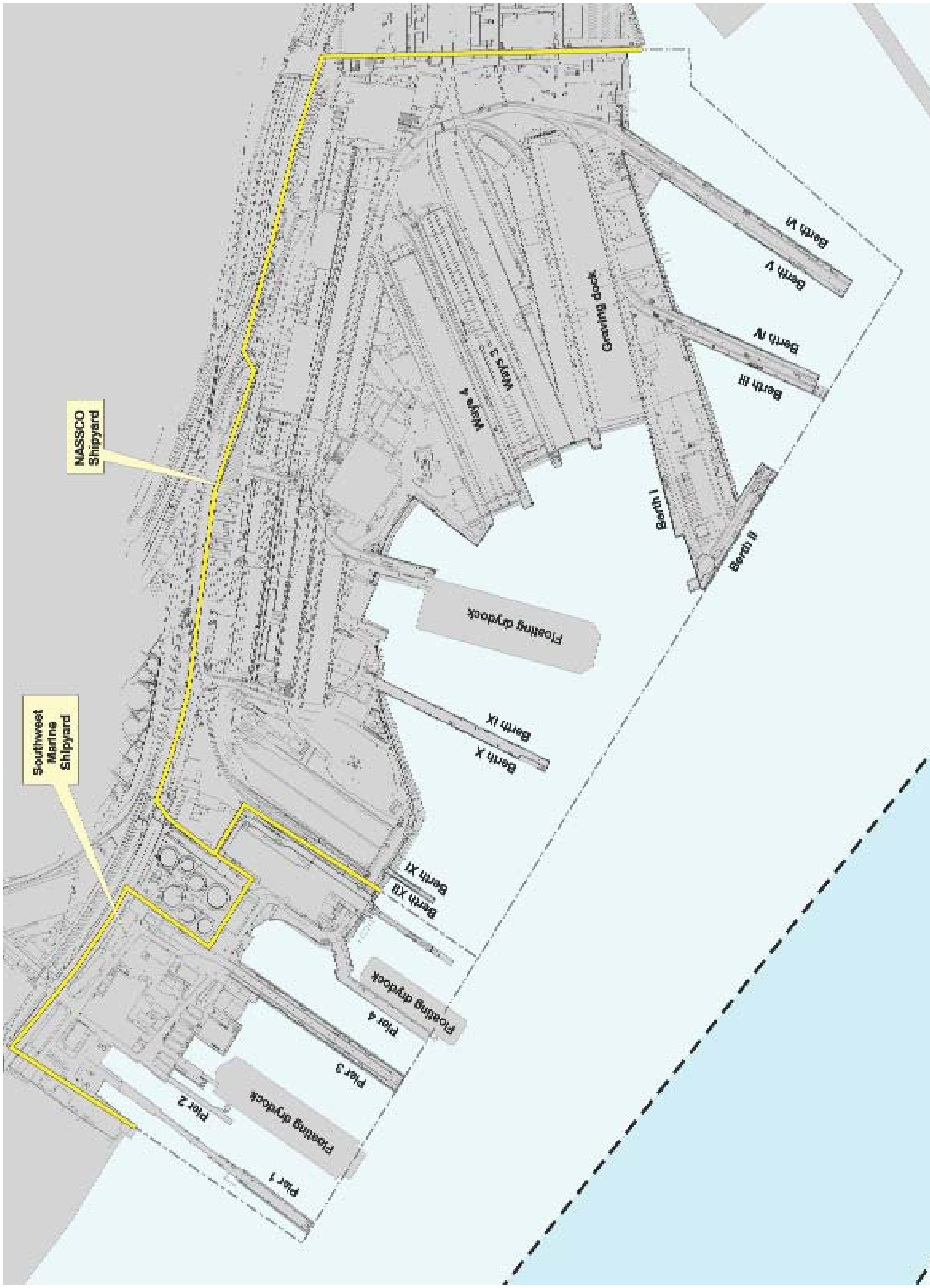

Figure 1-1. Shipyard Sediment Site (Exponent, 2003)

1.2 Elevated Pollutant Levels

The Regional Board compared sediment chemistry levels found at the Shipyard Sediment Site to various sediment quality guidelines (SQGs) as well as background sediment chemistry levels found in relatively “clean” areas of San Diego Bay. The purpose of this comparison was to evaluate if sediment chemistry levels at the Shipyard Sediment Site chemistry levels exceeded background conditions in San Diego Bay and the potential threat to aquatic life from chemical pollutants detected in the marine sediment.

Sediment quality guidelines are reference values above which sediment pollutant concentrations could pose a significant threat to aquatic life and can be used to evaluate sediment chemistry data. SQGs have been used by regulatory agencies, research institutions, and environmental organizations throughout the United States to identify contamination hot spots, characterize the suitability of dredge material for disposal, and establish goals for sediment cleanup and source control (Vidal and Bay, 2005)

The Regional Board used the following empirical SQGs to evaluate chemical levels at Shipyard Sediment Site stations: 1) Effects Range-Median (ERM) for metals (Long et al., 1998), 2) Consensus midrange effects concentration for PAHs and PCBs (Swartz, 1999; MacDonald et al., 2000), and 3) Sediment Quality Guideline Quotient (SQGQ) for chemical mixtures. The Regional Board also used chemistry levels found in relatively “clean” regions of San Diego Bay to compare Shipyard Sediment chemistry levels. The results of this evaluation indicated that pollutant levels for arsenic, copper, lead, mercury, zinc, PCBs, PAHs, and TBT in the sediment at the Shipyard Sediment Site are elevated and represent a potential threat to aquatic life. Additional details on SQGs and chemistry levels found at the Shipyard Sediment Site are provided in Section 16 of this Technical Report.

1.3 Responsible Parties

NASSCO, BAE Systems (formerly Southwest Marine Inc.), City of San Diego, Marine Construction and Design Company and Campbell Industries, Inc., San Diego Gas and Electric, a subsidiary of Sempra Energy Company, and the United States Navy are each named as dischargers in the Cleanup and Abatement Order, responsible for the cleanup of waste and the abatement of the effects of waste discharges at the Shipyard Sediment Site. This section provides an overview of the general principles applied by the Regional Board in determining the responsible parties identified in the Cleanup and Abatement Order.

1.3.1 Water Code Section 13304

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides that any person who has discharged or discharges waste[4] into waters of the state in violation of any waste discharge requirement[5] or other order or prohibition issued by a Regional Water Quality Control Board (Regional Board) or the State Water Resources Control Board (State Water Board) or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution[6] or nuisance[7] may be required to clean up the discharge and abate the effects thereof. This section authorizes Regional Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge)[8].

1.3.2 Resolution 92-49

State Water Resources Control Board Resolution No. 92-49, (*Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*) describes the policies and procedures that apply to the cleanup and abatement of all types of discharges subject to Water Code section 13304 (SWRCB, 1996). Resolution 92-49 provides that the Regional Board shall, in its decisions on who shall be held accountable for the cleanup and abatement of waste, use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

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[4] "Waste" is very broadly defined in Water Code section 13050(d) that includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal. See Sections 2.0 through 9.0 for discussion of the specific waste discharges. See Section 35.0 regarding legal and regulatory authority.

[5] The term waste discharge requirements include those which implement the National Pollutant Discharge Elimination System.

[6] Pollution is defined in Water Code section 13050(1) as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following: (A) The waters for beneficial uses, (B) Facilities which serve these beneficial uses." Pollution may include "contamination."

[7] Nuisance is defined in Water Code section 13050(m) "…. anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes."

[8] Finding 4 of State Water Resources Control Board Resolution 92-49, *Policies And Procedures For Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*, (As Amended on April 21, 1994 and October 2, 1996).

- Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
- Site characteristics and location in relation to other potential sources of a discharge;
- Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
- Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
- Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
- Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
- Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
- Reports and complaints;
- Other agencies' records of possible known discharge; and
- Refusal or failure to respond to Regional Board inquiries.

1.3.3 State Water Resources Control Board Decisions Dealing with Responsible Parties

The State Water Resources Control Board (State Water Board) has also, in a series of orders dealing with the review of Regional Water Quality Control Board decisions on who is responsible for cleanups, established the following general principles regarding responsible parties in cleanup and abatement orders:

- In general, name all persons who have caused or permitted a discharge (Orders Nos. WQ 85-7 and 86-16).
- "Discharge" is to be construed broadly to include both active discharges and continuing discharges (Order No. WQ 86-2).
- There must be reasonable basis for naming a responsible party (i.e., substantial evidence). It is inappropriate to name persons who are only remotely related to the problem such as suppliers and distributors of gasoline (WQ 85-7, 86-16, 87-1, 89-13, and 90-2).
- Persons who are in current possession, ownership or control of the property should be named, including current landowners and lessees (numerous orders, including WQ 84-6, 86-11, 86-18, 89-1, 89-8, 89-13 and 90-3). Lessee/sublessors may be responsible (WQ 86-15).

- Generally, RWQCBs should not try to apportion responsibility between parties (WQ 86-2 and 88-2).
- However, in some cases, current landowners should only be named as secondarily liable. Factors: Landowner did not cause or know of actual discharge; tenant, lessee or prior owner is responsible; cleanup is proceeding; and lease is long-term (WQ 86-l1, 86-18, 87-6, and 92-13). Secondary responsibility is also appropriate where landowner is trustee-type governmental agency such as Forest Service (WQ 87-5).
- Prior landowners and lessees should be named if they owned or were in possession of the site at the time of discharge, had knowledge of the activities that resulted in the discharge, and had the legal ability to prevent the discharge (numerous orders, including WQ 85-7, 86-15, 91-7 and 92-13). Narrow exceptions based on such factors as: site owned or leased for short time, person did not cause actual discharge, are other responsible parties, person did not use property, no or minimal knowledge of problem (WQ 92-4 and 92-13).
- It is appropriate to name government agencies as responsible parties (WQ 88-2, 89-12, and 90-3).
- Corporations should be named even where a dissolved corporation (WQ 89-14) or a successor in interest (WQ 89-8).

1.3.4 Responsible Parties Named as Dischargers

The Regional Board applied the principles cited above in determining who should be named as a discharger in the Cleanup and Abatement Order. For the reasons set forth in Sections 2, 3, 4, 5, 8, and 9 of this Technical Report the Regional Board determined that NASSCO, BAE Systems (formerly Southwest Marine Inc.), City of San Diego, Marine Construction and Design Company and Campbell Industries, Inc., San Diego Gas and Electric, a subsidiary of Sempra Energy Company, and the United States Navy have each caused or permitted the discharge of pollutants to the Shipyard Sediment Site resulting in the accumulation of pollutants in the marine sediment. Accordingly these parties are named as dischargers in the Cleanup and Abatement Order.

1.3.5 Parties the Regional Board Declined to Name as Dischargers

1.3.5.1 <u>ChevronTexaco, BP and the Atlantic Richfield Company (ARCO)</u>

The Regional Board applied the principles cited above in determining that Chevron, a subsidiary of ChevronTexaco, BP and the Atlantic Richfield Company (ARCO) should not be named as dischargers in the Cleanup and Abatement Order. For the reasons set forth in Sections 6 and 7 of this Technical Report the Regional Board determined that there is insufficient evidence to conclude that these parties contributed to the accumulation of pollutants in the marine sediment at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance.

1.3.5.2 Port of San Diego

The Regional Board has the discretion to name the Port of San Diego, a non-operating landowner, as a "discharger" in the Shipyard Sediment Site Cleanup and Abatement Order. The Regional Board is not now naming the Port of San Diego as a "discharger " in the Cleanup and Abatement Order but may do so in the future if the Port's tenants fail to comply with the Order.

1.3.5.2.1 The Port of San Diego May Be Named as a Discharger

The Port of San Diego is a special government entity, created in 1962 by the San Diego Unified Port District Act, California Harbors and Navigation Code in order to manage San Diego Harbor, and administer certain public lands along San Diego Bay. The Port of San Diego owns the land occupied by the NASSCO Shipyard facility, the BAE Systems San Diego Ship Repair Facility, and the cooling water tunnels for San Diego Gas and Electric Company's, Silver Gate Power Plant. The Port of San Diego also owned the land formerly occupied by the San Diego Marine Construction Company Inc. and Southwest Marine Inc. when they conducted shipbuilding and repair activities[9]. The Regional Board has the discretion to name the Port of San Diego, in the capacity of a non-operating landowner, as a "discharger" in the Shipyard Sediment Site Cleanup and Abatement Order. However, the Regional Board's exercise of this discretion should be consistent with previous State Water Board orders concerning the naming of non-operating public agencies in cleanup and abatement orders.

The Regional Board's discretion to hold landowners accountable for discharges which occurred on the landowner's property is based on three criteria. The Port of San Diego meets all three of these criteria:

- Ownership of the land;
- Knowledge of the activity causing the discharge; and
- The ability to control the activity.[10]

It is undisputed that the Port of San Diego owns the land leased by NASSCO, BAE Systems San Diego Ship Repair, Inc., San Diego Gas and Electric Company, and the land formerly leased by San Diego Marine Construction, Inc. and Southwest Marine, Inc. The Port of San Diego has land use authority on these lands and can control decisions regarding the sizing and sizing of facilities located on lands under its jurisdiction. The

[9] San Diego Marine Construction Company and Southwest Marine Inc. owned and operated ship repair and construction facilities in past years prior to BAE Systems San Diego Ship Repair, Inc.'s occupation of the leasehold. See Sections 3 and 5.

[10] These principles on the issue of landowner liability under both waste discharge requirements and enforcement orders were established in a series of orders adopted by the State Water Resources Control Board and in memoranda issued by the State Board Office of Chief Counsel. (See e.g., State Board Order Nos. WQ 87-6, 87-5, 86-18, 86-16, 86-15, 86-11, 84-6, 90-03; Memorandum dated May 8, 1987 from William R. Attwater to Regional Board Executive Officers entitled "Inclusion of Landowners in Waste Discharge Requirements and Enforcement Orders").

Port of San Diego has, through its interactions with the Regional Board over many years, known of the potential for discharges from the NASSCO, BAE Systems, Southwest Marine, Inc, San Diego Marine Construction, Inc., and San Diego Gas and Electric Company facilities to contribute to accumulations of pollutants in San Diego Bay sediment to deleterious levels. Finally it is also clear that the Port of San Diego had the ability under its lease agreements with these entities to impose controls that could prevent or reduce waste discharges.

In years past, the State Water Board examined the terms of a lease in order to ascertain whether the landlord has the legal power to prevent a discharge[11]. In Order No. WQ 84-6 (page 12), for example the State Water Board concluded that former landowner/lessors had the opportunity to obviate dangerous conditions on their property on the basis of lease provisions stipulating that "the tenant shall not commit waste or nuisance on the premises, and shall obey all laws, state, federal, and local, with respect to the use of the premises". In addition, the State Water Board cited a term of the lease authorizing the landowners to renter the premises upon the failure of the tenant to perform any of its obligations under the lease.

Past lease agreements between the Port of San Diego and its tenants typically contained terms similar to those discussed in State Water Board Order No. WQ 84-6. For example, Port of San Diego leases reviewed by the Regional Board in years past obligated its tenants to "abide by and conform to … any applicable laws of the State of California and Federal Government…". The Port of San Diego's leases required its tenants to keep the leased premises in a clean and sanitary condition, free and clear of waste. The leases authorized the Port of San Diego to enter and inspect the leased premises at any time during normal business hours. The leases also authorized the Port of San Diego to terminate the lease after 60 days written notice, if the tenant defaulted in the performance of the lease provisions. Under State Water Board Order No. WQ 84-6, these lease terms would be sufficient to base a finding that the Port of San Diego had the requisite degree of control over a tenant's activities.

Based upon the three elements of ownership, knowledge of, and the ability to regulate the discharges which occurred during the lease terms, the Regional Board can conclude that that the Port of San Diego caused or permitted waste to be discharged into San Diego Bay, creating a condition of pollution in the Bay at the Shipyard Sediment Site. Although it is within the Regional Board's discretion to name the Port of San Diego in the Cleanup and Abatement Order, to do so at this time would be inconsistent with previous State Water Board orders concerning the naming of non-operating public agencies in cleanup and abatement orders.

[11] See State Water Resources Control Board Order Nos. WQ 84-6 and 86-15.

1.3.5.2.2 The Port of San Diego Should Only Bear Secondary Responsibility at this Time

In certain situations, the State Water Board has found it appropriate to consider a lessee primarily responsible and the landowner secondarily responsible for compliance with the cleanup and abatement order. A secondarily responsible party is one that is not obligated to comply with the cleanup and abatement order unless the primarily responsible party fails to do so. State Water Board Orders WQ 86-10 and 87-6 identified factors that should be considered in determining whether it is appropriate to assign secondary liability to the Port District for compliance with the Cleanup and Abatement Order. These factors include:

- The status of the lessee's compliance with the Order;
- The ability of the landowner to control the property, including the status of the lease agreement, the authority of the lessor under the lease, and the lessor's current ability to conduct the cleanup; and
- The landowner's role, if any, in the discharge of waste.

In general, the State Water Board Orders held that a landowner party may be placed in a position of secondary liability where it did not cause or permit the activity that led to the initial discharge into the environment and there is a primarily responsible party who is performing the cleanup. Other factors considered by the State Water Board include whether the landowner:

- Is a public entity that should be treated in a manner similar to the U.S. Forest Service in State Water Board Order WQ 87-05;
- Has a limited ability to conduct cleanup because another party has control over the site; and
- Contributed to or aggravated pollution conditions at the site.

While the Regional Board concludes that the Port of San Diego may be named as a "discharger" in the Cleanup and Abatement Order, the Board also concludes that the Port of San Diego should only bear secondary responsibility for the cleanup at this time and that it is not presently necessary to name the Port of San Diego in the Cleanup and Abatement Order. The Port of San Diego is a public government entity[12]. There is no evidence in the record that the Port of San Diego initiated or contributed to the actual discharge of waste to the Shipyard Sediment Site. The Port's leases with its tenants are long-term and there is no evidence in the record at this time indicating that NASSCO, BAE Systems, San Diego Gas and Electric Company, Marine Construction and Design Company, and Campbell Industries, Inc. have insufficient financial resources to cleanup the Shipyard Sediment Site. The major Shipyard Sediment Site investigations to determine the extent of pollution at the Shipyard Sediment Site were satisfactorily completed by NASSCO and Southwest Marine, Inc. (currently BAE Systems San Diego Ship Repair, Inc.). The Port of San Diego is a responsible public agency that is well

[12] See California Harbors and Navigation Code, Appendix I, section 28.

equipped under its lease agreements to coordinate or require compliance of its tenants with the cleanup and abatement orders issued by the Regional Board. Naming the Port of San Diego in the Cleanup and Abatement Order at this juncture may create an additional adversarial situation and hinder cooperation with the Regional Board in a cleanup that is already highly contested by other dischargers. There is no need to name the Port of San Diego in the Cleanup and Abatement Order as a "discharger" with primary responsibility for compliance until it becomes clear that the Port's tenants have failed to comply with the order. Based on these considerations the Regional Board is not now naming the Port of San Diego as a "discharger " in the Cleanup and Abatement order but may do so in the future if the Port's tenants fail to comply with the Order.

1.4 Pollution and Contamination Conditions at the Shipyard Sediment Site

Water Code section 13304 requires a person to clean up waste or abate the effects of the waste if so ordered by a regional board in the following circumstances if there has been a discharge in violation of waste discharge requirements, or if a person has caused or permitted waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates or threatens to create a condition of pollution or nuisance. "Pollution" is defined as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects … the waters for beneficial uses… ."[13] "Contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected."[14]

Contaminated marine sediment at the Shipyard Sediment Site threaten San Diego Bay beneficial uses and create a condition of pollution and contamination in waters of the State. The pollution and contamination conditions found at the site described in the subsections below are the result of the discharge of waste by the responsible parties described in Section 1.3.4, above.

1.4.1 Overview of Potential Adverse Effects[15]

Bay bottom marine sediment provides habitat for many aquatic organisms and functions as an important component of aquatic ecosystems. Sediment also serves as a major repository for persistent and toxic chemical pollutants released into the environment. In the aquatic environment, chemical waste products of anthropogenic (human) origin that do not easily degrade can eventually accumulate in sediment. The environmental threat associated with elevated levels of pollutants in sediment is caused by the tendency of many chemical substances discharged into marine waters to attach to sediment particles and thus accumulate to high concentrations in the bay bottom sediment.

[13] Water Code section 13050(1).
[14] Water Code section 13050(k).
[15] Adapted from U.S. EPA. 1997d.

Adverse effects on organisms in or near sediment can occur even when pollutant levels in the overlying water are low. Benthic (bottom-dwelling) organisms can be exposed to pollutants in sediment through direct contact, ingestion of sediment particles, or uptake of dissolved contaminants present in the interstitial (pore) water. In addition, natural and human disturbances of the sediment can release pollutants to the overlying water, where pelagic (open-water) organisms can be exposed. Evidence from laboratory tests shows that contaminated sediment can cause both immediate lethality (acute toxicity) and long-term deleterious effects (chronic toxicity) to benthic organisms. Field studies have revealed other effects, such as tumors and other lesions, on bottom-feeding fish. These effects can reduce or eliminate species of recreational, commercial, or ecological importance (such as crabs, shrimp, and fish) in water bodies either directly or by affecting the food supply that sustainable populations require.

Furthermore, contaminated sediment can also lead to the accumulation of pollutants in organisms due to the effects of bioaccumulation. In addition, biomagnification of the contaminants can occur in the food chain when smaller contaminated organisms are consumed by higher trophic level species, including humans. Thus pollutants in the marine sediment might accumulate in edible tissue to levels that cause health risks to wildlife and human consumers.

In summary, contaminated marine sediment are a threat to water quality and beneficial uses for the following reasons:

- Various toxic contaminants found only in barely detectable amounts in the water column can accumulate in sediment to much higher levels.
- Sediment serves as both a reservoir for contaminants and a source of contaminants to the water column and organisms.
- Sediment integrates contaminant concentrations over time, whereas water column contaminant concentrations are much more variable and dynamic.
- Sediment contaminants (in addition to water column contaminants) affect bottom-dwelling organisms and other sediment-associated organisms, as well as both the organisms that feed on them and humans.
- Sediment is an integral part of the aquatic environment that provides habitat, feeding, spawning, and rearing areas for many aquatic organisms.

1.4.2 San Diego Bay Beneficial Uses

The Water Quality Control Plan for the San Diego Basin (Basin Plan) designates the following 12 beneficial uses for San Diego Bay that must be protected against water quality degradation. These beneficial uses are applicable to the Shipyard Sediment Site[16]. (RWQCB, 1994):

- **Estuarine Habitat (EST) –** Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds);
- **Marine Habitat (MAR**) - Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds);
- **Migration of Aquatic Organisms (MIGR) –** Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish;
- **Wildlife Habitat (WILD) –** Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources;
- **Preservation of Biological Habitats of Special Significance (BIOL) –** Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection;
- **Rare, Threatened, or Endangered Species (RARE) –** Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered;
- **Contact Water Recreation (REC-1**) **–** Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs;

[16] See Basin Plan Table 2-3 on Page 2-47.

- **Non-contact Water Recreation (REC-2) –** Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities;
- **Shellfish Harvesting (SHELL) –** Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes;
- **Commercial and Sport Fishing (COMM) –** Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes;
- **Navigation (NAV) –** Includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels; and
- **Industrial Service Supply (IND) –** Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

1.4.2.1 Adverse Effects to San Diego Bay Beneficial Uses

Contaminated marine sediment at the Shipyard Sediment Site threatens three categories of beneficial uses: aquatic life, aquatic-dependent wildlife, and human health. San Diego Bay beneficial uses applicable to each of these categories are tabulated in Table 1-1 . Actual or potential impairments to these beneficial use categories are described in the following sections of this Technical Report:

- Aquatic life impairments are discussed in Sections 12 to 21.
- Aquatic dependent wildlife impairments are discussed Sections 22 to 25.
- Human health impairments are discussed in Sections 26 to 29.

Table 1-1. San Diego Bay Beneficial Uses That Impact Aquatic Life, Aquatic Dependent Wildlife and Human Health.

AQUATIC LIFE	AQUATIC-DEPENDENT WILDLIFE	HUMAN HEALTH
Estuarine Habitat (EST)	Wildlife Habitat (WILD)	Contact Water Recreation (REC-1)
Marine Habitat (MAR)	Preservation of Biological Habitats of Special Significance (BIOL)	Non-Contact Water Recreation (REC-2)
Migration of Aquatic Organisms (MIGR)	Rare, Threatened or Endangered Species (RARE)	Shellfish Harvesting (SHELL)
		Commercial and Sport Fishing (COMM)

Table 1-2. Overview of Impacts to Aquatic Life, Aquatic Dependent Wildlife and Human Health.

Description of Adverse Effects Observed	Technical Report Section	Beneficial Uses Adversely Impacted
Elevated Sediment Chemistry. Sediment chemistry levels at the site exceed sediment quality guideline thresholds and reference sediment chemistry levels. Chemicals present in the sediment, therefore, have the potential to adversely impact organisms living in or on the sediment (i.e., benthic community).	16	MAR, MIGR
Bulk Sediment Toxicity. Amphipod survival rates in bulk sediment samples from the site are significantly less than the control ($p \leq 0.05$) and/or are less than the survival rates observed at the reference condition.	16	MAR, MIGR
Pore Water Toxicity. Sea urchin egg fertilization in pore water samples from the site is significantly less than the control ($p \leq 0.05$).	16	MAR, MIGR
Sediment-Water Interface Toxicity. Mussel embryo development in sediment-water interface samples from the site is significantly less than the control ($p \leq 0.05$) and is less than the embryo development observed at the reference condition.	16	MAR, MIGR
Benthic Community Degradation. Benthic community structure observed in samples from the site deviate from the reference threshold defined by the Benthic Response Index for Embayments (BRI-E). The BRI-E reference condition represents a community in the absence of sediment chemical contamination.	16	MAR, MIGR
Benthic Community Degradation. Species abundance in a bulk sediment sample from the site is less than the species abundance observed at the reference condition.	16	MAR, MIGR
Benthic Community Degradation. Number of taxa in bulk sediment samples from the site is less than the number of taxa observed at the reference condition.	16	MAR, MIGR
Benthic Community Degradation. Species diversity in a bulk sediment sample from the site is less than the species diversity observed at the reference condition.	16	MAR, MIGR
Bioaccumulation. For many chemical pollutants, concentrations in clam tissue increase as chemical pollutant concentrations in sediment increases. Indicates the likelihood of chemicals entering the aquatic food web.	17	MAR, MIGR, WILD, BIOL, RARE, SHELL, COMM

Description of Adverse Effects Observed	Technical Report Section	Beneficial Uses Adversely Impacted
Elevated Pore Water Chemistry. Pore water chemistry levels at the site exceed California Toxics Rule water quality criteria. Chemicals present in the pore water, therefore, have the potential to adversely impact the benthic community.	18	MAR, MIGR
Impacts to Fish Health. Lesions were observed on spotted sand bass collected at the site that exhibited statistically significant elevations relative to spotted sand bass collected at a reference area. Several of the lesions may be associated with contaminant sediment exposure.	19	MAR, MIGR, COMM
Impacts to Fish Health. PAH metabolites in bile from spotted sand bass collected at the site exhibited elevated levels relative to spotted sand bass collected at a reference area. Increased levels may be associated with contaminant sediment exposure.	20	MAR, MIGR, COMM
Aquatic-Dependent Wildlife Risks. Hazard quotients calculated at the site exceed 1.0 and are greater than the hazard quotients calculated at the reference area. Ingestion of prey items at the site, therefore, poses a risk to wildlife receptors of concern.	25	MAR, WILD, RARE
Human Health Risks. Cancer risks calculated at the site exceed the target cancer risk level of $1x10^{-6}$ and are greater than the cancer risks calculated at the reference area. Ingestion of fish and shellfish caught at the site, therefore, poses a cancer risk to recreational and subsistence anglers.	29	SHELL, COMM
Human Health Risks. Non-cancer risks calculated at the site exceed the target non-cancer risk level of 1.0 and are greater than the non-cancer risks calculated at the reference area. Ingestion of fish and shellfish caught at the site, therefore, poses a non-cancer risk to recreational and subsistence anglers.	29	SHELL, COMM

1.4.2.2 Navigation (NAV) and the Industrial Service Supply (IND) Beneficial Uses

Contaminated marine sediment at the Shipyard Sediment Site may also threaten San Diego Bay Navigation (NAV) and the Industrial Service Supply (IND) beneficial uses if cleanup of the Shipyard Sediment Site does not occur. Shipping, travel, or transportation by private, military, or commercial vessels is an important beneficial use in San Diego Bay. The protection of this beneficial use is dependent upon maintaining appropriate depths in shipping channels and vessel berthing areas by carrying out maintenance dredging. The Navigation (NAV) beneficial use can be adversely affected when maintenance-dredging projects are stymied due to water quality problems associated with the resuspension and migration of pollutants from contaminated bay sediment to previously uncontaminated areas. The Navigation beneficial use can also be affected when pollutants in bay sediment complicate the disposal of dredged sediment by exceeding criteria for the ocean disposal of dredged sediment or the beneficial reuse of dredged sediment (e.g. beach replenishment) from maintenance dredging projects. The Industrial Service Supply (IND) beneficial use can be adversely affected by pollutants migrating from the sediment into the water column causing a decline in water quality conditions.

The Cleanup and Abatement Order does not specifically identify impairments to the Navigation (NAV) or the Industrial Service Supply (IND) beneficial uses. It is assumed that cleanup levels protective of the beneficial uses tabulated in Table 1-1 will also be protective of the Navigation (NAV) or the Industrial Service Supply (IND) beneficial uses.

1.4.3 San Diego Bay Water Quality Objectives

The Basin Plan sets narrative and numerical water quality objectives[17] that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy (RWQCB, 1994). The narrative water quality objective for toxicity[18] applicable to San Diego Bay and the Shipyard Sediment Site provides that:

> *"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."*
>
> *"The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with requirements specified in US EPA, State Water Resources Control Board or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute bioassay."*
>
> *"In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data*

[17] "Water quality objectives" are defined in Water Code section 13050(h) as "the limits or levels water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

[18] Basin Plan, Chapter 3. Water Quality Objectives, Page 3-15.

> *become available, and source control of toxic substances will be encouraged."*

"Pollution" is defined under Water Code section 13050(l), in part, to mean an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects beneficial uses. A condition of pollution exists when applicable water quality objectives are violated as a result of the discharge of waste.

A suite of three bioassay tests was conducted to test for toxicity of marine sediment at the Shipyard Investigation Site. The majority of samples collected were significantly different than the negative (clean) control sample. Some of these same samples also exceeded the 95 percent prediction limit threshold value for that particular test. Processing the test responses in a toxicity decision matrix found 43 percent (13 out of 30 stations) to be moderately toxic and 57 percent to have low toxicity. Further details are provided in Section 16.

1.4.4 California Toxics Rule

U.S. EPA promulgated a final rule prescribing water quality criteria for toxic pollutants in inland surface waters, enclosed bays, and estuaries in California in 2000 (The California Toxics Rule or "CTR;").[19] CTR criteria constitute applicable water quality objectives in California. In addition to the CTR, certain criteria for toxic pollutants in the National Toxics Rule (NTR) [40 CFR 131.36] constitute applicable water quality objectives in California as well.

Comparisons were made to the CTR saltwater quality criterion continuous concentration, which is the highest concentration of a pollutant to which marine aquatic life can be exposed for an extended period of time without deleterious effects. Of the 12 site stations sampled for pore water, 12 stations exceeded the copper CTR value, 6 stations exceeded the lead CTR value, and 12 stations exceeded the total PCBs CTR value. Further details are provided in Section 18.

[19] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

1.5 Nuisance Conditions at the Shipyard Sediment Site

Deposits of pollutant waste in marine sediment at the Shipyard Sediment Site cause nuisance conditions because of the following:

1. There is an increased health risk to humans that consume fish and shellfish from San Diego Bay that swim in and bioaccumulate pollutants from the Shipyard Sediment Site;
2. There is a community of affected persons, including a considerable number of persons from minority populations, that consume fish and shellfish with a greater potential for adverse health effects; and
3. There is obstruction to the public's free use of property.

1.5.1 Definition of Nuisance

Water Code section 13050 (m) cites three criteria, which determine whether nuisance conditions exist in waters of the state:

> *"Nuisance" means anything that meets all of the following requirements:*
>
> *(1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.*
>
> *(2) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.*
>
> *(3) Occurs during, or as a result of, the treatment or disposal of wastes.*

The pollution and contamination conditions found at the Shipyard Sediment Site meet all three criteria.

1.5.2 Increased Human Health Risk Associated with Consumption of San Diego Bay Fish

Fish consumption is the primary route of human exposure to the pollutants found at the Shipyard Sediment Site. Humans eat fish and shellfish that swim in and bioaccumulate pollutants from the Shipyard Sediment Site. The Regional Board evaluated potential impacts on human health by estimating potential carcinogenic risks and non-carcinogenic hazards associated with the consumption of Shipyard Sediment Site pollutants that bioaccumulate in fish and shellfish tissue. The Regional Board used U.S. EPA procedures for estimating human health risks due to the consumption of chemically contaminated fish tissue and employed appropriate human fish consumption rates and bioaccumulation factors in the analysis. The Regional Board concludes in Section 29 of this Technical Report that human ingestion of seafood caught within all four assessment units at the Shipyard Sediment Site poses a cancer risk greater than $1x10^{-6}$ (i.e., 1 in 1,000,000 extra chance of cancer over a lifetime) and non-cancer risk greater than 1 to both recreational and subsistence anglers. The Regional Board also concludes the Shipyard Sediment Site poses a greater cancer and non-cancer risk to recreational and subsistence anglers than the risks posed at reference conditions in San Diego Bay. The carcinogenic chemicals of concern include total polychlorinated biphenyls (PCBs) and inorganic arsenic. The non-carcinogenic chemicals of concern include cadmium, copper, mercury, and total PCBs. The calculations and results are provided in the Appendix for Section 29.

1.5.2.1 <u>PCB Health Effects</u>

U.S. EPA (2000b) has classified PCBs as “probable human carcinogens.” Studies have suggested that PCBs may play a role in inducing breast cancer. Studies have also linked PCBs to increased risk for several other cancers including liver, biliary tract, gall bladder, gastrointestinal tract, pancreas, melanoma, and non-Hodgkin’s lymphoma. PCBs may also cause non-carcinogenic effects, including reproductive effects and developmental effects (primarily to the nervous system). PCBs tend to accumulate in the human body in the liver, adipose tissue (fat), skin, and breast milk. PCBs have also been found in human plasma, follicular fluid, and sperm fluid. Fetuses may be exposed to PCBs in utero, and babies may be exposed to PCBs during breastfeeding. According to U.S. EPA (2000b), “[s]ome human studies have also suggested that PCB exposure may cause adverse effects in children and developing fetuses while other studies have not shown effects. Reported effects include lower IQ scores, low birth weight, and lower behavior assessment scores.”

1.5.2.2 <u>Inorganic Arsenic Health Effects</u>

Arsenic is strongly associated with lung and skin cancer in humans, and may cause other internal cancers as well. Skin lesions, peripheral neuropathy, and liver and kidney disorders are hallmarks of chronic arsenic ingestion (U.S. EPA, 2000b).

1.5.2.3 <u>Cadmium Health Effects</u>

Kidney toxicity is the primary concern with cadmium exposure (U.S. EPA, 2000b). Chronic exposure to cadmium may also include anemia and bone disorders, including osteomalacia, osteoporosis, and spontaneous bone fractures. Some studies have suggested an association between neurotoxicity and cadmium exposure at levels below those that cause kidney toxicity. According to U.S. EPA (2000b), reproductive and developmental toxicity have been associated with cadmium ingestion.

1.5.2.4 Copper Health Effects

Large intakes of copper can cause liver or kidney damage, or even death in cases of extreme exposure. People with Wilson's disease have a genetic defect that results in the accumulation of copper in tissues, including the liver, kidney, and cornea. The excess copper in this sensitive subgroup can cause damage to the kidney, liver, and brain; hemolytic anemia; and other effects (Peterson et al., 2005).

Short periods of exposure to levels above the U.S. EPA's Action Level of 1.3 parts per million can cause gastrointestinal disturbance, including nausea and vomiting. Use of water that exceeds this Action Level over many years could cause liver or kidney damage (U.S. EPA, 1995).

1.5.2.5 Mercury Health Effects

Methylmercury (CH_3Hg) is the form of mercury that builds up in the tissues of fish and is the most toxic. It affects the immune system, alters genetic and enzyme systems, and damages the nervous system, including coordination and the senses of touch, taste, and sight. Exposure to methylmercury is usually by ingestion, and it is absorbed more readily and excreted more slowly than other forms of mercury (U.S. Geological Survey, 2000).

Methylmercury readily crosses the placental and blood/brain barriers (U.S. EPA, 2000b) and is particularly damaging to developing embryos, which are five to ten times more sensitive than adults (U.S. Geological Survey, 2000). Studies found that offspring born of women exposed to methylmercury during pregnancy have exhibited a variety of developmental neurological abnormalities, including the following: delayed onset of walking, delayed onset of talking, cerebral palsy, altered muscle tone and deep tendon reflexes, and reduced neurological test scores (U.S. EPA, 1997e).

1.5.3 Adversely Affected Community from Consumption of San Diego Bay Fish

There are people in the local community that catch and consume fish and shellfish from San Diego Bay. The San Diego Bay Health Risk Study (County of San Diego, 1990), summarized in Section 1.5.3.2 below, reported that 74 percent of people who catch and consume fish from the Bay are people of color. The 1990 study reported that consumption patterns of ethnic populations indicate that they tend to eat more fish in their diet and eat parts of the fish that have higher pollutant accumulation. This group of anglers, including their family members that may also consume fish and shellfish caught in San Diego Bay, has a disproportionately higher health risk from pollution in the San Diego Bay than other San Diego Bay anglers.

1.5.3.1 Environmental Justice

Environmental justice is defined in California law[20] as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies." The California Environmental Protection Agency (Cal EPA), and it's Boards, Departments, and Offices, which include the State and Regional Water Boards, are charged[21] with conducting its programs, policies, and activities in a manner that ensures the fair treatment of people of all races, cultures, and income levels, including minority populations and low-income populations of the state.

Cal EPA's stated mission, as described in its 2004 Intra-Agency Environmental Justice Strategy, is to accord the highest respect and value to every individual and community, by developing and conducting our public health and environmental protection programs, policies, and activities in a manner that promotes equity and affords fair treatment, accessibility, and protection for all Californians, regardless of race, age, culture, income, or geographic location. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

1.5.3.2 County of San Diego, 1990 San Diego Bay Health Risk Study

The County of San Diego's 1990 report, *San Diego Bay Health Risk Study*, identified the demographics and consumption patterns of people in the San Diego Region who catch and consume fish from San Diego Bay. Three hundred and sixty nine (369) anglers [22] were surveyed over a period of one year from October 1988 through October 1989. The survey was used to:

- Identify the species of fish most commonly caught by anglers of San Diego Bay;
- Identify the demographics of the population of anglers who catch fish; and
- Characterize the fish consumption patters of the anglers and others who may consume fish.

The San Diego Bay angler interview locations selected by the California Department of Fish and Game included Glorietta Bay, Coronado Ferry Landing, Shelter Island, Harbor Island, Spanish Landing, Embarcadero Park, Sweetwater Port District, the City of Chula Vista Bayside Park, and G Street Pier. Boat launches were also surveyed for anglers returning with their catch from the Bay.

The majority of anglers surveyed lived in municipalities adjacent to San Diego Bay. Table 1-3 provides a breakdown of the anglers' place of residence.

[20] Government Code section 65040.12(e).
[21] Public Resources Code sections 71110 – 71113.
[22] An angler is a person who catches fish with a hook.

Table 1-3. Anglers' Reported Place of Residence

Residence	Percent of Total Anglers Interviewed[1]
City of San Diego	50.7%
City of Chula Vista	10.6 %
City of National City	8.1 %
San Diego County	15.9%
Outside San Diego County	3.5%
Undetermined	11.1%

[1] County of San Diego (1990) Table IV-D, Demographic Profile of 369 Anglers.

Five distinct ethnic subpopulations were identified as constituting significant portions of the interviewed anglers: Caucasian, Filipino, Hispanic, Asian (Vietnamese, Laotian, Japanese, Cambodian, Chinese, Korean and Thai) and Black. Table 1-4 provides a comparison of fishing patterns for the ethnic populations surveyed.

Table 1-4. Comparison of Fishing Patterns by Ethnicity

Ethnicity	Percent of Total Anglers[1]	Fishing Frequency (Times per Month)[2]	Percent of Anglers that Caught and Ate Fish	Average Yield (grams of fish /successful trip)[3]	Percent of Anglers who Fish Year Round
Caucasian	42.0	7.3	37.2	1,028	78.9
Filipino	20.1	7.1	73.6	2,156	60.9
Hispanic	12.5	4.5	40.0	969	52.6
Asian[4]	11.1	4.8	87.9	1,791	38.7
Black	6.5	3.9	38.9	1,896	79.2
Other Ethnic Groups[5]	2.2	7.3	50.0	767	62.5
Unidentified	5.6	NC	100.0	326	NC
Total Population	**100**	**6.4**	53.4	**1,504**	**67.8**

[1] County of San Diego (1990) Table IV-D, Demographic Profile of 369 Anglers.
[2] A 30-day month was assumed.
[3] Based on interviews only where catch was consumed.
[4] Group includes Vietnamese, Laotian, Japanese, Cambodian, Chinese, Korean, and Thai.
[5] Group includes Indian, American, Indian, Hawaiian, and Polynesian.
NC = not calculated
(Table IV-E; County of San Diego, 1990)

County of San Diego (1990) drew the following conclusions from the data in Table 1-4:

- Caucasians and Filipinos were the most frequent anglers at 7.3 and 7.1 times per months respectively. Asians, Hispanics and Blacks were less frequent at 4.8, 4.5 and 3.9 times per month.
- Filipinos caught and consumed fish 73.6 percent of the time while Asians caught and consumed fish 87.9 percent of the time. Caucasians, Hispanics and Blacks all caught and consumed fish 40 percent or less of the time. This may indicate that Filipinos and Asians, more than other populations, are fishing in San Diego Bay for food rather than sport.
- In terms of average yield of fish in grams per successful trip (when fish were caught) Filipinos and Asians tended to be more successful than other portions of the population at 2,156 grams and 1,791 grams/successful trip respectively.
- In terms of the percentages of each population that fish year round, Blacks and Caucasians had the highest percentages at 79.2 % and 78.9 % respectively. Values for other populations ranged from a low of 38.7% for Asians to a high of 60.9% for Filipinos. These values are difficult to interpret because they do not contain any indication of what portion of the year was fished.

County of San Diego (1990) also evaluated patterns of consumption by ethnicity and the distribution of risk between ethnic groups. The results are summarized in Table 1-5, below.

Table 1-5. Comparison of Consumption Patterns By Ethnicity

Ethnicity	Percent of Total Consumers[1]	Percent of Total Measured Catch[2]	Projected Percent of Total Catch[2]	Consumption Rate (g/day)[3]
Caucasian	24	24.6	37.8	10.8
Filipino	32.6	39.0	28.7	49.5
Asian[4]	25.6	22.8	16.4	81.9
Hispanic	8.9	5.7	5.5	23.6
Black	4.7	6.5	9.7	NC[5]
Other Ethnic Groups[6]	2.2	1.4	1.9	NC[5]
Total	100	100	100	31.2

[1] This distribution is based on a sample size of 143 interviews, representing 490.5 potential consumers.
[2] These percentages represent only catch that was indicated would be consumed. These calculations assume that successful anglers not represented in the measured catch are catching fish at the same rate as those who are represented.
[3] Consumption rates calculated using the following factors: fish weight, a cleaning factor, number of consumers, and fishing frequency.
[4] Group includes Vietnamese, Laotian, Japanese, Cambodian, Korean, and Thai.
[5] NC = not calculated. Sample sizes for these groups are insufficient to allow calculations of consumption rates.
[6] Group includes Indian, American Indian, Hawaiian, Polynesian, and Unidentified.
(Table IV-F; County of San Diego, 1990)

County of San Diego (1990) drew the following conclusions from the data in Table 1-5 and other data contained in the report:

- Filipinos were determined to represent 32.6 percent of the total consumers in spite of the fact that they comprise only 20.1 percent of all anglers. Although Asians represent only 11.1 percent of the total anglers, 25.6 percent of the total consumers were Asian. Caucasians were determined to represent only 24 percent of the total consumers in spite of the fact that they comprise only 42 percent of all anglers. Hispanics and blacks made up only 8.9 percent and 4.7 percent of the totals consumers respectively.
- Caucasians were projected to consume 37.8 percent of the total consumed fish catch. Filipinos and Asians were projected to consume 28.7 percent and 16.4 percent of the total consumed fish catch respectively. Blacks and Hispanics were projected to consume the smallest portion of the total consumed fish catch at 9.7 percent and 5.5 percent respectively. While these estimates give some indication of the relative portion of total contaminated fish ingested by each group, it is important to note that other factors, such as the parts of a fish consumed may influence the actual amount of contaminants consumed.

- The fish consumption rate of 10.8 grams/day for Caucasians is considerably lower than the 31.2 grams/day determined for the entire population. The fish consumption rates for Filipinos, Asians and Hispanics were considerably higher than the Caucasian fish consumption rate. However limitations on population sample sizes especially for Hispanics and Asians, make comparisons of the consumption rates problematic[23].

  Individuals that consume a greater portion of the fish, such as internal organs may be at greater risk of consuming a greater amount of contaminants. Other data contained in Appendix J, Table J-10, Comparison of Parts Eaten By Ethnicity of County of San Diego (1990) indicates there were significant variations between ethnic populations in the parts of fish consumed. Only 5.6 percent of Caucasian anglers consumed the entire fish and 66.7 percent eat only the muscle. Approximately 40 percent of both Filipinos and Asians consume the entire fish. This means that on the average a given amount of fish consumed may result in a lower amount of ingested contaminants for Caucasians as compared to Filipinos and Asians.

1.5.3.3 Environmental Heath Coalition, Survey of Fishers on Piers in San Diego Bay

The Environmental Health Coalition (EHC)[24] conducted what they classified as an "opportunity" sample survey in 2004 of people fishing from piers near the Shipyard Sediment Site, NAVSTA San Diego and in the south end of San Diego Bay to ensure the interests of this population were considered in the Cleanup and Abatement Order decision-making process. The EHC described the survey group as a "…selective sample that is highly exposed to fish from near the shipyards, Naval Station San Diego, and the southern portion of San Diego Bay". The results of this survey are contained in a report titled, "*Survey of Fishers on Piers in San Diego Bay, Results and Conclusions*" (EHC, 2005), and are summarized below.

[23] The fish consumption rates for Caucasians were estimated based on an interview sample size of 20 or more. The consumption rates for Asians and Hispanics were based on an interview sample size of 4 and 5 interviews respectively, and should only be considered an approximation of the actual consumption rates for those groups.

[24] The Environmental Health Coalition (EHC), is a self–described nonprofit environmental justice organization in San Diego dedicated to the prevention and cleanup of toxic pollution, monitoring actions causing pollution and educating communities about toxics.

The EHC reported that a total of 109 fishers were interviewed in English, Spanish, or Tagalog, as appropriate, during the winter and spring of 2004. Piers surveyed by EHC included the following:

Fishing Pier	**Approximate Miles from Shipyard Sediment Site**
Convention Center pier (downtown San Diego)	1.7
Pepper Park Pier (National City)	3.2
Chula Vista Pier	5.1

EHC (2005) reported the following:

- Of all of the fishers surveyed, the places of residence supplied by the interviewees were as follows:
    - Eighty three percent (83%) lived in EHC target communities such as the following:
        - National City (59%);
        - Barrio Logan (14%);
        - Western Chula Vista and Imperial Beach (10%); and
    - Seven percent (7%) lived in Tijuana, Mexico.
- Ninety-six percent of the fishers surveyed were people of color and consisted of the following ethnic groups:
    - Fifty seven percent (57%) Latino; and
    - Thirty nine percent (39%) Filipino.
- Of the surveyed fishers, the fishing patterns consisted of the following:
    - Fifty eight percent (58%) fished at least once a week; and
    - Twenty five percent (25%) fished daily.
- Almost two thirds (61%) of the fishers reported that they eat the fish they catch and two percent give the fish away.
- Of the surveyed fishers, 78 percent have children and 41 percent of those children eat fish caught from the Bay.
- Thirteen percent (13%) of the fishers surveyed reported eating fish skin, among them people who fish frequently and who catch large amounts of fish.

- Of the fishers surveyed, 73 percent eat other types of seafood in addition to what they catch.

The Regional Board recognizes that there are limitations to the EHC Survey. The survey was not a representative sample of all San Diego Bay fishers or all South Bay residents. The survey assumed income based on place of residence and the appearance that someone appeared to be engaged in subsistence fishing.

1.5.4 Obstruction of Public's Free Use of Property

The presence of pollutants in the sediment at the Shipyard Sediment Site in concentrations that might accumulate in edible tissue to levels that cause human health risks is a threat to the public health. The interference and complications with the consumption of fish and shellfish contaminated by pollutants from the Shipyard Sediment Site is an obstruction to the public's free use of San Diego Bay and its aquatic life resources.

San Diego Bay is bordered by the cities of San Diego, National City, Chula Vista and Coronado, with an estimated population of approximately 1.2 million persons. San Diego County has a population of over 2.4 million and is growing at a rate of about 50,000 per year. By the year 2010 there are predicted to be 3.5 million residents in the county, most of them in the metropolitan western portion.

San Diego Bay is an important and valuable resource to San Diego and the Southern California region. It provides habitat for fish and wildlife, extensive commercial and industrial economic benefits, and recreational opportunities to citizens and visitors. It is also a key element for the military security of the United States. The Bay is also a significant economic value to California and the Nation. It provides considerable shelter from ocean waves and is one of the finest natural harbors in the world. The Bay is a major tourist and convention destination, international shipping center, plays a key role in the national defense, and has many other recreational, industrial, and commercial uses. Most of these uses rely on a healthy Bay. Shipping, shipbuilding, boat repair, tourism, and other industries are either directly dependent on, or otherwise benefit from, the Bay. Because of its beauty and availability as a recreational resource, San Diego Bay is a major draw for the tourist industry. In 1997, tourism in the greater San Diego area accounted for 14 million overnight visitors and 4.4 billion dollars in income. Much of this activity occurred around San Diego Bay and downtown San Diego where the hotels and San Diego Convention Center are located.

San Diego Bay is designated as a State Estuary under Section 1, Division 18 (commencing with section 28000) of the Public Resources Code. A State Estuary is defined as a California saltwater bay or body of water, receiving freshwater stream flows, which supports human beneficial uses and wildlife and merits high priority action for preservation.

1.5.5 Summary of Nuisance Condition

The waste at the Shipyard Sediment Site constitutes a public nuisance because it is injurious to human health and obstructs the free use of property and interferes with the comfortable enjoyment of life and property, and affects at the same time an entire community where the extent of the annoyance or damage inflicted upon individuals is unequal.

Human ingestion of seafood caught at the Shipyard Sediment Site poses an increased risk of cancer and toxicity to both recreational and subsistence anglers. This increased risk is based on total PCBs, inorganic arsenic, cadmium, copper, and mercury concentrations found in spotted sand bass and lobster tissue and whole body measurements. The *San Diego Bay Health Risk Study* (County of San Diego, 1990) reported PCBs and mercury in fish species caught by anglers in San Diego Bay.

The *San Diego Bay Health Risk Study* (County of San Diego, 1990) demonstrates that a considerable number of persons exists within the community surrounding San Diego Bay that consumes fish from the Bay that contain levels of contaminants, which are also found in sediment of the Shipyard Sediment Site, that have the potential to adversely effect their health. The survey by EHC (2005) supports the findings in the 1990 *San Diego Bay Health Risk Study* that a number of San Diego Bay anglers are people of color who fish frequently, consume their catch, and sometimes prepare the fish in ways that maximize exposure to contaminants.

Consistent with the Cal EPA's Environmental Justice Strategy, the San Diego Water Board must promote enforcement of the Clean Water Act and California Water Code in a manner that ensures the fair treatment of people of all races, cultures, and income levels. A failure to act by the Regional Board would violate principles of environmental justice because the health risk from regular consumption of fish caught in the San Diego Bay falls disproportionately on minority groups.

The consumption of fish and shellfish contaminated by pollutants from the Shipyard Sediment Site creates a threat to human health and an obstruction to the public's free use of San Diego Bay and its aquatic life resources thus interfering with the enjoyment of life and property.

2. Finding 2: National Steel and Shipbuilding Company (NASSCO), A Subsidiary of General Dynamics Company

The National Steel and Shipbuilding Company, a subsidiary of General Dynamics Company (hereinafter NASSCO) owns and operates a full service ship construction, modification, repair, and maintenance facility on 126 acres of tidelands property leased from the San Diego Unified Port District (SDUPD) on the eastern waterfront of central San Diego Bay at 2798 Harbor Drive in San Diego. Shipyard operations have been conducted at this site by NASSCO over San Diego Bay waters or very close to the waterfront since 1945. Shipyard facilities operated by NASSCO over the years at the Site have included concrete platens used for steel fabrication, a graving dock, shipbuilding ways, and berths on piers or land to accommodate the berthing of ships. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. (hereinafter NASSCO) has (1) caused or permitted pollutants waste from its shipyard operations, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH), to be discharged to San Diego Bay in violation of waste discharge requirements prescribed by the Regional Board.; and NASSCO also (2) discharged or deposited waste where it was discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from NASSCO's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations NASSCO is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

NASSCO**,** a subsidiary of General Dynamics Company, owns and operates a full service ship construction, modification, repair, and maintenance facility on 126 acres of tidelands property leased from the San Diego Unified Port District (SDUPD) on the eastern waterfront of central San Diego Bay at 2798 Harbor Drive in San Diego. Shipyard operations have been conducted at this site by NASSCO over San Diego Bay waters or very close to the waterfront since 1945. Shipyard facilities operated by NASSCO over the years at the Site have included concrete platens used for steel fabrication, a graving dock, shipbuilding ways, and berths on piers or land to accommodate the berthing of ships. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse.

2.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of the state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that the National Steel and Shipbuilding Company (NASSCO)**,** a subsidiary of General Dynamics Company, should be named as a discharger in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

2.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;

4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

2.3 NASSCO Owns and Operates a Full Service Ship Construction, Modification, Repair, and Maintenance Facility

2.3.1 Facility Description

From 1945 to the present, the National Steel and Shipbuilding Company**,** a subsidiary of General Dynamics Company (hereinafter NASSCO) owns and operates a full service ship construction, modification, repair, and maintenance facility on approximately 126 acres of tidelands property on the eastern waterfront of central San Diego Bay. The facility is located on land leased from the San Diego Unified Port District (SDUPD) at 28th Street and Harbor Drive in San Diego, California. NASSCO's primary business has historically been ship repair, construction, and maintenance for the U.S. Navy and commercial customers. The facility covers approximately 126 acres of tidelands on property leased from the San Diego Unified Port District. The land portion and offshore area of the lease are comprised of approximately 80 acres and 46 acres, respectively. Current site improvements include offices, shops, warehouses, concrete platens for steel fabrication, a floating dry dock, a graving dock, two shipbuilding ways, and five piers, which provide 12 berthing spaces.

Shipbuilding and repair operations at NASSCO historically encompassed a large number and variety of activities and industrial processes including, but not limited to, formation and assembly of steel hulls; application of paint systems; installation and repair of a large variety of mechanical, electrical, and hydraulic systems and equipment; repair of damaged vessels; removal and replacement of expended/failed paint systems; and provision of entire utility/support systems to ships (and crews) during repair.

There are three major types of building/repair facilities at NASSCO, which, together with cranes, enable ships to be assembled, launched, or repaired. These facilities are a floating drydock, a graving dock, and berths/piers. With the exception of berths and piers, the basic purpose of each facility is to separate a vessel from the bay to provide access to parts of the ship normally underwater. NASSCO currently has a floating drydock, a graving dock, and five piers, which provide 12 berthing spaces and two (2) shipbuilding ways. The berths and piers are over-water structures where vessels are tied during repair or construction activities. Because drydock space is limited and expensive, many operations are conducted pier side. For example, after painting the parts of a ship normally underwater, the ship is moved from the drydock to a berth where the remainder of the painting is completed.

Prior to the early 1990's, when a storm water first-flush capture system was installed for portions of the facility, all surface water runoff from NASSCO discharged directly into San Diego Bay. Capture of first-flush storm water from high-risk areas (dry dock, graving dock, paint and blasting areas) was initiated by NASSCO in the early 1990s. Capture of first-flush storm water was extended to additional areas of the facility in 1997 (Exponent, 2003).

2.3.2 Activities Conducted by NASSCO

The primary activities at NASSCO involve a multitude of industrial processes, many of which are conducted over San Diego Bay waters or very close to the waterfront. As a result of these processes, an assortment of wastes is generated. The industrial processes at NASSCO include the following:

- **Surface Preparation and Paint Removal**. Methods of surface preparation and paint removal include dry abrasive blasting, wet abrasive or slurry blasting, hydroblasting, and chemical paint stripping;
- **Paint Application**. After preparation, surfaces are painted. Most painting occurs in a drydock and involves the ship hull and internal tanks. Painting is also conducted in other locations throughout the shipyard including piers and berths. Paint application is accomplished by way of air or airless spraying equipment and is a major activity at NASSCO;
- **Tank Cleaning**. Tank cleaning operations use steam to remove dirt and sludge from internal tanks, particularly fuel tanks and bilges. Detergents, cleaners, and hot water may be injected into the steam supply hoses. NASSCO reports that wastewater generated has typically been removed and disposed of at an on-site treatment facility;
- **Mechanical Repair/Maintenance/Installation**. A variety of mechanical systems and machinery require repair, maintenance, and installation;
- **Structural Repair/Alteration/Assembly**. Structural repair, alteration, and assembly generally involve welding, cutting, and fastening of steel plates or assembly blocks and other industrial processes;
- **Integrity/Hydrostatic Testing**. Hydrostatic or strength testing and flushing are conducted on hulls, tanks, or pipe repairs. Integrity testing is also conducted on new systems during ship construction phases;

- **Paint Equipment Cleaning**. All air and airless paint spraying equipment is typically cleaned following use. Paint equipment cleaning is a major producer of waste, including solvents, thinners, paint wastes, and sludges;
- **Engine Repair/Maintenance/Installation**. Automotive repair, ship engine repair, maintenance, and installation generate waste oils, solvents, fuels, batteries, and filters;
- **Steel Fabrication and Machining**. Fabrication of engine and ship parts occurs at NASSCO. Cutting oils, fluids, and solvents are used extensively, including acetone, methyl ethyl ketone (MEK) and chlorinated solvents;
- **Electrical Repair/Maintenance/Installation**. The repair, maintenance, and installation of electrical systems involves the use of numerous hazardous materials including trichlorethylene, trichloroethane, methylene chloride, and acetone;
- **Hydraulic Repair/Maintenance/Installation**. The repair, maintenance, and installation of hydraulic systems involves the replacement of spent hydraulic oils;
- **Tank Emptying**. Bilge, fuel, and ballast tanks are typically emptied prior to ship repair activities;
- **Fueling**. Fueling operations occur at NASSCO;
- **Shipfitting**. Shipfitting is conducted at NASSCO, and is defined as the forming of ship plates and shapes, etc. according to plans, patterns, or molds;
- **Carpentry**. Woodworking, with associated wood dust production, is conducted at NASSCO; and
- **Refurbishing/Modernization/Cleaning**. Refurbishing, modernization, and cleaning of ships are conducted at NASSCO.

2.3.3 Materials Used at NASSCO

Materials commonly used at NASSCO are summarized below. Although a few specific materials are included, the list consists primarily of major categories.

- **Abrasive Grit**. Abrasive grit sometimes consists of slag collected from coal-fired boilers and contains iron, aluminum, silicon, and calcium oxides. Other metals, such as copper, zinc, and titanium are also sometimes present. Sand, cast iron, or steel shot are also used as abrasives. Enormous amounts of abrasive are needed to remove paint; removing paint from a 15,000 square foot hull can take up to 6 days and consume 87 tons of grit. Grit is needed in all dry and wet abrasive blasting.

- **Paint**. Paints contain copper, zinc, chromium, and lead as well as hydrocarbons. Two major types of paints used on ship hulls are:
  - Anticorrosive paints, vinyl, vinyl-lead, or epoxy-based coatings are used. Others contain zinc chromate and lead oxide; and
  - Antifouling paints are used to prevent growth and attachment of marine organisms by continuously releasing toxic substances into the water. Cuprous oxide and tributyltin fluoride or tributyltin oxide are the principal toxicants in copper-based and organotin-based paints, respectively.
- **Miscellaneous Materials**. Oils (engine, cutting, and hydraulic), lubricants, grease, fuels, weld, detergents, cleaners, rust inhibitors, paint thinners, hydrocarbon and chlorinated solvents, degreasers, acids, caustics, resins, adhesives/cement/sealants, and chlorine.

2.3.4 Wastes Generated by NASSCO

Categories of wastes commonly generated by NASSCO's industrial processes include, but are not limited to, those listed below.

- **Abrasive Blast Waste**. Spent Grit, Spent Paint, Marine Organisms, and Rust. Abrasive blast waste, consisting of spent grit, spent paint, marine organisms, and rust is generated in significant quantities during all dry or wet abrasive blasting procedures. The constituent of greatest concern with regard to toxicity is the spent paint, particularly the copper and tributyltin antifouling components, which are designed to be toxic and to continuously leach into the water. Other pollutants in paints include zinc, chromium, and lead. Abrasive blast waste can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters. Based on available data for the years 1987 through 1991, NASSCO generates an average of 198 tons of abrasive blast waste per month.
- **Fresh Paint**. Losses occur when paint ends up somewhere other than its intended location (e.g., drydock floor, bay, worker's clothing). These losses result from spills, drips, and overspray. Typical overspray losses are estimated at approximately 5 percent for air spraying; and 1 to 2 percent for airless spraying.
- **Bilge Waste/Other Oily Wastewater**. This waste is generated during tank emptying, leaks, and cleaning operations (bilge, ballast, fuel tanks, etc). In addition to petroleum products (fuel, oil), tank washwater also contains detergents or cleaners and is generated in large quantities.
- **Blast Wastewater**. Hydroblasting generates large quantities of wastewater. In addition to suspended and settleable solids (spent abrasive, paint, rust, marine organisms) and water, blast wastewater also contains rust inhibitors such as diammonium phosphate and sodium nitrite.
- **Oils (engine, cutting, and hydraulic)**. In addition to spent products, fresh oils, lubricants, and fuels are released as a result of spills and leaks from ship or

drydock equipment, machinery, and tanks (especially during cleaning and refueling).

- **Waste Paints/Sludges/Solvents/Thinners**. These wastes are generated from cleaning paint equipment.
- **Construction/Repair Wastes and Trash**. These wastes include scrap metal, welding rods, slag (from arc welding), wood, rags, plastics, cans, paper, bottles, packaging materials, etc.
- **Miscellaneous Wastes**. These wastes include lubricants, grease, fuels, sewage (black and gray water from vessels or docks), boiler blowdown, condensate, discard, acid wastes, caustic wastes, and aqueous wastes (with and without metals).

2.3.5 Abrasive Blast Waste and Other Waste Discharges - Sampling Results

During numerous inspections, Regional Board inspectors observed abrasive blast waste and other wastes deposited in areas where it would probably be discharged into the waters of the state via stormwater runoff (see Section 2.7 NASSCO Waste Discharges). Samples of abrasive blast waste and other wastes were collected in the vicinity of storm drains, or in other areas susceptible to being transported to San Diego Bay via stormwater runoff, during inspections on August 3, 1989, August 14, 1989, October 16, 1991, and February 27, 1992.

2.3.5.1 <u>May, June, and August 1989 Inspections and Sampling</u>

The Regional Board conducted a series of inspections during May, June, and August 1989. Abrasive blast waste was noted on Harbor Drive or other locations during inspections on May 31, 1989, June 29, 1989, August 1, August 2, August 3, August 7, August 8, and August 14 where it would probably be discharged into San Diego Bay via stormwater runoff. The June 29, 1989 inspection report noted, "Sandblast waste was on the sidewalk at the same location noted during the NPDES inspection on 5-31-89." The Regional Board Executive Officer sent a letter dated July 5, 1989 to NASSCO via certified mail requesting:

> "…immediate action to correct the deficiencies noted regarding: 1) sandblast and other waste discharges from the dry dock to San Diego Bay; 2) sandblast waste discharges to Harbor Drive; 3) failure to clean storm drain sumps; and 4) failure to properly certify monitoring reports."

During the August inspections, Samples LKM 890-52-A and LKM 890-37-A of the abrasive blast waste were collected and analyzed for metals. Sample LKM 890-52-A was collected from waste next to a sump near Building 6. The inspector reported that "…the sandblast pit is a major problem. Sandblast waste is everywhere w/o runoff controls"

(RWQCB, 1989a). Sample LKM 890-37-A was collected from the blasting pit area. The analytical results are presented in Table 2-1, below.

2.3.5.2 October 16, 1991 Inspection and Sampling

During an inspection on October 16, 1991, the Regional Board inspector noted violations of the NPDES permit and reported "a threaten[ed] discharge to the storm drains from blasting, painting and dust collection activities in the yard" (RWQCB, 1991). Abrasive blast waste was noted in the vicinity of storm drain inlets within the grit blast and painting area near the southeast corner of the NASSCO facility. Samples GRF 912-064A and GRF 912-064B were collected from gray and rust colored grit near the storm drain inlets at this location. The analytical results are shown in Table 2-1, below.

The Regional Board inspector noted that two of the storm drains had valves that were shut and that another storm drain was covered with a steel plate with an opening in the middle. In a response letter dated December 18, 1991, NASSCO reported "a berm was installed around Storm Drain #3 in the grit blast and paint areas of the facility. A drain pipe was embedded though the berm, with a valve on the storm drain side to control discharges." However, in the same December 18, 1991 letter, NASSCO reported rainwater that backed up around the berm at Storm Drain #3 "…was discovered missing." NASSCO indicated that they would take additional actions to avoid this happening in the future (Haumschilt, 1991).

In the primer line yard, sample GRF 912-064C was collected from smoke gray, powdery residue. The Regional Board inspector noted that this area is open to potential contamination from the outside dust collection activity conducted at this location. The analytical results for sample GRF 912-064C are shown in Table 2-1, below.

2.3.5.3 February 27, 1992 Inspection and Sampling

During an inspection on February 27, 1992, the Regional Board inspector noted spent abrasive blast waste on the surfaces of Storm Drain #2 and in the vicinity of Storm Drain #7. One sample (GRF 912-142) of sandy grit was collected near Storm Drain #7. In a response letter dated May 1, 1992, NASSCO indicated that they would initiate corrective actions in response to the findings of threatened discharges noted during the inspection (Snider, 1992).

Table 2-1. Abrasive Blast Waste Sampling Results

Chemical	LKM 890-52-A	LKM 890-37-A	GRF 912-064A	GRF 912-064B	GRF 912-064C	GRF 912-142	Alternative Sediment Cleanup Levels	Background
Date	**8/3/89**	**8/14/89**	**10/16/91**	**10/16/91**	**10/16/91**	**2/27/92**		
Metals								
Arsenic (mg/kg)	136	57.8	< 24.1	60.2	< 22.6	< 210	**10**	7.5
Chromium (mg/kg)	93.5	31.9	1,520	147	547	1,870	**81**	57
Copper (mg/kg)	3,240[(1)]	1760	2,270	3,130[(1)]	388	955	**200**	121
Lead (mg/kg)	264	114	< 12	320	< 11.3	< 105	**90**	53
Mercury (µg/kg)	< 49	< 49	< 48	< 47	< 48	< 42	**0.7**	0.57
Nickel (mg/kg)	31.9	6.4	939	37.5	345	1,130	**20**	15
Silver (mg/kg)	4.76	1.96	5.01	1.09	2.03	< 16.8	**1.5**	1.1
Zinc (mg/kg)	1,240	268	19,800[(1)]	2,620	2,690	2,200	**300**	129

The result exceeds criteria for characterization of hazardous waste per California Code of Regulations, Title 22, Chapter 11, Section 66261.24. The total threshold limit concentration (TTLC) for copper is 2500 mg/kg and the TTLC for zinc is 5000 mg/kg. The TTLC represents the total concentration of a constituent that may be present before a waste is classified as a hazardous waste.

2.3.5.4 Discussion of Sampling Results

The inspections and analytical results indicate that abrasive blast wastes and other waste with elevated levels of metals have been discharged or deposited where they were, or probably would have been, discharged into San Diego Bay having created, or having threatened to create, a condition of pollution or nuisance. The analytical laboratory results for chromium, copper, nickel, and zinc for at least 5 of the six waste samples exceed the background and alternative sediment cleanup levels presented in Sections 31 and 34 of this Technical Report, respectively. The copper results for four of the samples are approximately 10 times the alternative sediment cleanup levels. Similarly the results for zinc are several times the alternative cleanup levels in five out of six samples.

In addition, two of the samples (LKM 890-52-A and GRF 912-064B) exceed the criteria for total concentration of copper that may be present before the waste is classified as hazardous waste due to toxicity, and one of the samples (GRF 912-064A) exceed the hazardous waste classification criteria for zinc (CCR Title 22). The waste would be classified as hazardous waste and proper disposal would be in a Class I Landfill licensed to receive hazardous waste.

2.4 NASSCO Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirements

NASSCO has caused or permitted waste from its shipyard operations to be discharged to San Diego Bay in violation of waste discharge requirements. The waste contains metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and probably polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs).

NASSCO's waste discharges are regulated pursuant to Clean Water Act section 402 and Water Code section 13376. NASSCO must comply with all conditions of the Shipyard NPDES Permit requirements. These requirements are referred to as either NPDES requirements[25] or by the federal terminology "NPDES Permit". Any noncompliance of Shipyard NPDES Permit requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304. Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides, in relevant part, that the Regional Board

[25] Pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Act, to avoid the issuance by the United States Environmental Protection Agency of separate and duplicative NPDES permits for discharges in California that would be subject to the Clean Water Act, the State's Waste Discharge Requirements (WDRs) for such discharges implement the NPDES regulations and entail enforcement provisions that reflect the penalties imposed by the Clean Water Act for violation of NPDES permits issued by the U.S. EPA. Thus, the State's WDRs that implement federal NPDES regulations (NPDES requirements) serve in lieu of NPDES permits.

may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement…"

NASSCO Shipyard NPDES Permit requirement violations are documented in the Regional Board records via discharger monitoring and spill reports (filed by NASSCO), citizen complaints, Regional Board inspection reports, and Regional Board Notices of Violation issued to NASSCO. NASSCO's discharges of waste in violation of waste discharge requirements are presented in Sections 2.3, 2.7, 2.8, and 2.9 of this Technical Report.

2.5 NASSCO Discharged Waste to San Diego Bay Creating a Condition of Pollution, Contamination, and Nuisance Conditions in San Diego Bay

NASSCO has discharged waste, or deposited waste where it was discharged, into San Diego Bay and created, or threatened to create, a condition of pollution, contamination, and nuisance. Water Code section 13304 requires that a person who causes any waste to be discharged, or deposited where it probably will be discharged, into waters of the state creating, or threatening to create, a condition of pollution or nuisance is subject to cleaning up or abating the effects of the waste.

Pollutants generated at the NASSCO facility as a result of shipyard activities include metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PAHs, TPH, and probably PCBs, and PCTs. These same pollutants are present in the marine sediment adjacent to the NASSCO facility in highly elevated concentrations as compared to sediment chemistry levels found at off-site reference stations located in areas of San Diego Bay.[26]

The Shipyard Report (Exponent, 2003) provides the following findings about the distribution of elevated sediment chemical concentrations at the Shipyard Sediment Site:

- Elevated concentrations of metals are found near the municipal storm drain outfall in the BAE Systems leasehold and in the center of the NASSCO leasehold near the floating drydock;
- Elevated concentrations of PCBs are found near the northern boundary of BAE Systems, at the storm drain outfall on BAE Systems' leasehold, and at the foot of Sicard Street near the common boundary between the two shipyards (BAE Systems and NASSCO);
- Petroleum hydrocarbons are distributed similarly to metals and PCBs, with an additional area of elevation near the southern boundary of NASSCO's leasehold; and

[26] See Section 15 of this Technical Report.

- Concentrations of all chemicals generally decrease with distance from shore.

NASSCO has a history of discharging pollutants to San Diego Bay as a result of systemic problems and overall inadequacies in the implementation of its Best Management Practices Program to prevent such discharges. Some of NASSCO's discharges are presented in Sections 2.7, 2.8, 2.9, and 2.10 of this Technical Report. As described in Sections 12 through 29 of this Technical Report, these same pollutants in the discharges have accumulated in San Diego Bay sediment adjacent to the NASSCO facility in concentrations that:

1. Adversely affect the beneficial uses of San Diego Bay as described in later sections of this Technical Report;
2. Violate a NPDES requirement prohibitions pertaining to discharges that cause pollution, contamination, or nuisance[27] conditions in San Diego Bay; and
3. Violate NPDES requirements pertaining to discharges that degrade marine communities, cause adverse effects on the environment or the public health, or result in harmful concentrations of pollutants in marine sediment.

The Porter-Cologne Water Quality Act defines "pollution" as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects… …the waters for beneficial uses …"[28] "Contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected."[29]

Accordingly, it is concluded that NASSCO has caused or permitted the discharge of waste to San Diego Bay in a manner causing the creation of pollution, contamination, and nuisance conditions and that it is appropriate for the Regional Board to issue a cleanup and abatement order naming NASSCO as a discharger pursuant to Water Code section 13304.

Further discussions on pollution, contamination, and nuisance are available in Sections 1.4 and 1.5 of this Technical Report.

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[27] NASSCO's discharges of pollutants at the Shipyard Sediment Site have created or threaten to create a condition of nuisance in waters of the State. The discharges have caused or contributed to the accumulation of pollutants in the sediment in concentrations that are potentially injurious to the public health and affects a considerable number of persons as provided in Water Code section 13050(m).
[28] Water Code section 13050(1).
[29] Water Code section 13050(k).

2.6 NPDES Requirement Regulation

Waste discharges from the NASSCO facility have historically been regulated under Waste Discharge Requirements (WDRs) prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. These requirements are referred to as either NPDES requirements[30] or by the federal terminology "NPDES Permit". NASSCO's first NPDES requirements started in 1974, when the Regional Board issued WDRs to regulate specific shipyard activities (hereafter referred to as Shipyard NPDES Permit). A listing of the NPDES requirements adopted by the Regional Board in effect at the time the facility was owned and operated by NASSCO is provided in Table 2-2 below.

Table 2-2. NASSCO NPDES Permits

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 74-79, Shipyard NPDES No. CA0107671	Waste Discharge Requirements For National Steel And Shipbuilding Company	November 4, 1974	October 29, 1979
Order No. 79-63, Shipyard NPDES No. CA0107671	Waste Discharge Requirements For The National Steel And Shipbuilding Company	October 29, 1979	June 10, 1985
Order No. 85-05, Shipyard NPDES No. CA0107697	Waste Discharge Requirements For National Steel And Shipbuilding Company San Diego County	June 10, 1985	October 15, 1997
Order No. 97-36, Shipyard NPDES No. CAG039001	Waste Discharge Requirements For Discharges From Ship Construction, Modification, Repair, And Maintenance Facilities And Activities Located In The San Diego Region (TTWQ/CPLX 1A)	October 15, 1997	February 5, 2003

[30] Pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Act, to avoid the issuance by the United States Environmental Protection Agency of separate and duplicative NPDES permits for discharges in California that would be subject to the Clean Water Act, the State's Waste Discharge Requirements (WDRs) for such discharges implement the NPDES regulations and entail enforcement provisions that reflect the penalties imposed by the Clean Water Act for violation of NPDES permits issued by the U.S. EPA. Thus, the State's WDRs that implement federal NPDES regulations (NPDES requirements) serve in lieu of NPDES permits.

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. R9-2003-0005, Shipyard NPDES No. CA0109134	Waste Discharge Requirements For National Steel And Shipbuilding Company San Diego County	February 5, 2003	Present

Pursuant to the NPDES requirements cited above, NASSCO was required to develop and implement "Best Management Practices"[31] (BMPs) plans to limit discharges of pollutants into San Diego Bay. As described in the current NPDES requirements, R9-2003-0005, BMPs may be "structural" (e.g., tarpaulins and shrouds to enclose work areas, retention ponds, devices such as berms to channel water away from pollutant sources, and treatment facilities) or "non-structural" (e.g., good housekeeping, preventive maintenance, personnel training, inspections, and record-keeping). Beginning in 1997 numerical effluent limitations for oil and grease, settleable solids, turbidity, pH, and temperature were established in the NPDES requirements for certain discharges (e.g. Non-Contact Cooling Water; Miscellaneous Low Volume Water, and Fire Protection Water).

In 1992, NASSCO obtained coverage under the State Water Board's 1991 General Industrial NPDES Requirements for storm water discharges. These NPDES requirements supplemented NASSCO's NPDES requirements listed in Table 2-2. The industrial storm water NPDES requirements applied specifically to discharges of pollutants through storm water, while the NPDES permits listed in Table 2-2 applied to other discharges. A listing of the General Industrial NPDES Requirements for storm water discharges adopted by the State Water Board in effect at the time the facility was owned and operated by NASSCO is provided in Table 2-3 below.

[31] Best management practices ("BMPs") means schedules of activities, prohibitions of maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Table 2-3. NASSCO General Industrial NPDES Permits

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 91-13-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	(Notice of Intent Filed) November 4, 1992	(Notice of Intent Filed) February 5, 1998
Order No. 97-03-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	(Notice of Intent Filed) February 5, 1998	(Superseded by R9-2003-0005, Shipyard NPDES No. CA0109134) February 5, 2003

The General Industrial NPDES Requirements for storm water discharges required NASSCO to develop and implement plans to limit its discharges of pollutants from storm water runoff into San Diego Bay. Rather than relying on specific numerical effluent limitations, the NPDES requirements directed NASSCO to create and follow "Best Management Practices" (BMPs). The General Industrial NPDES Requirements for storm water discharges also required NASSCO to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) and a Storm Water Pollution Monitoring Plan (SWPMP). The requirements specified that the SWPPP include, among other things, the following:

- Descriptions of sources that might add significant quantities of pollutants to storm water discharges;
- A detailed site map;
- Descriptions of materials that had been treated, stored, spilled, disposed of, or leaked into storm water discharges since November 1988;
- Descriptions of the management practices that were employed to minimize contact between storm water and pollutants from vehicles, equipment, and materials;
- Descriptions of existing structural and non-structural measures to reduce pollutants in storm water discharges;
- Descriptions of methods of on-site storage and disposal of significant materials;
- Descriptions of outdoor storage, manufacturing, and processing activities;
- A list of pollutants likely to be present in significant quantities in storm water discharges and an estimate of the annual amounts of those pollutants in storm water discharge;

- Records of significant leaks or spills of toxic or hazardous pollutants to storm water;
- Summary of existing data describing pollutants in storm water discharge;
- Descriptions of storm water management controls, including good housekeeping procedures, preventive maintenance, and measures to control and treat polluted storm water; and
- A list of the specific individuals responsible for developing and implementing the SWPPP.

The above requirements were incorporated into, and superseded by, Order No. R9-2003-0005, Shipyard NPDES No. CA0109134 upon adoption on February 5, 2003.

2.6.1 Order No. 74-79, Shipyard NPDES Permit No. CA0107671

Order No. 74-79, Shipyard NPDES Permit No. CA0107671, was in effect from November 4, 1974 to October 29, 1979, and contained the following key requirement that relates to the discussions contained herein:

- B. PROVISIONS … 1. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination or nuisance as defined in the California Water Code.

2.6.2 Order No. 79-63, Shipyard NPDES Permit No. CA0107671

Order No. 79-63, Shipyard NPDES Permit No. CA0107671, in effect from October 29, 1979 to June 10, 1985, contained the following key requirement that relates to the discussions contained herein:

- B. PROVISIONS … 1. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination or nuisance as defined in the California Water Code.

2.6.3 Order No. 85-05, Shipyard NPDES Permit No. CA0107671

Order No. 85-05, Shipyard NPDES Permit No. CA0107671, in effect from June 10, 1985 to October 15, 1997 contained the following key requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The deposition or discharge of refuse, rubbish, materials of petroleum origin, spent abrasives (including old primer and antifouling paint), paint, paint chips, or marine fouling organisms into San Diego Bay or at any place where they would be eventually transported to San Diego Bay is prohibited;

- B. DISCHARGE SPECIFICATIONS … 2. Effluent discharged to San Diego Bay must be essentially free of: …(b) Settleable material or substances that form sediments which degrade benthic communities or other aquatic life. …(c) Substances toxic to marine life due to increases in concentrations in marine waters or sediments. …;
- B. DISCHARGE SPECIFICATIONS … 3. The discharger shall comply with the Water Pollution Control Plan described in Finding No. 7.

  Finding 7 states: The Water Pollution Control Plan details the following measures for controlling the pollutants identified in Finding 6: A. FLOATING DRYDOCK (1) During sandblasting and painting the dock basin will be under constant cleaning to remove sandblast grit and paint chips. Mechanical sweepers and skip loaders will be employed in the cleaning operations. (2) The dock will be encased in an oil boom during sandblasting and painting to contain overspray. (3) Prior to drydock flooding, the entire dock floor will be swept broom-clean and all trash will be removed from the dock. (4) The wastewater from ship's bilge tanks will be pumped into vacuum trucks and transported to a disposal site approved by the Regional Board Executive Officer. (5) All waste categories will be transferred to proper containers and disposed of at a dumpsite approved by the Regional Board Executive Officer. B. SHIPBUILDING DRYDOCK (BUILDING POSITION NO. 1) AND SHIPBUILDING WAYS (BUILDING POSITIONS NOS. 2, 3, AND 4) (1) All dock basins will be subjected to the same sweep cleaning procedures as outline for the floating drydock prior to flooding of the dock and during the sandblasting and painting operation. (2) All waste categories will be removed from drainage channels and sumps at least once a month. All controllable water sources shall be routed directly to the drainage channels by hose to avoid contact with any waste categories. C. OTHER FACILITIES (1) A floating catch barge will be used when sandblasting or paint chipping a ship over water. During this operation the barge will be rigged with burlap curtains to prevent the blast material from reaching the bay water. (2) Sanitary wastes will be discharged to the San Diego Metropolitan sewer system, except in the case of sanitary wastes collected in portable chemical toilets, which will be disposed of by an authorized waste hauler. (3) Open work areas will be routinely swept to maintain broom clean grounds. Mechanical sweepers will be available and several dumpsters will be placed at strategic locations around the NASSCO premises. (4) All storm drains shall be directed through screen baskets designed to entrap solid waste categories and prevent their discharge in the bay. These settling tanks shall be cleaned immediately following each rainfall. D. ACCIDENTAL SPILLS Accidental spills could result in the release of liquid pollutants such as fuel, oil, paints or sewage. The control and prevention of spills are generally covered in the NASSCO Spill Prevention and Contingency Plan dated March 1984. The plan outlines the procedures to be followed for the prevention, control, or cleanup of spills;

- C. RECEIVING WATER LIMITATIONS. The National Steel and Shipbuilding Company's discharge shall not cause violation of the following water quality objectives in San Diego Bay: … 5. Toxicity (a) All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. … ;
- D. PROVISIONS … 1. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined by section 13050 of the Water Code; and
- D. PROVISIONS … 11. The discharger shall at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Order.

2.6.4 Order No. 97-36, Shipyard NPDES Permit No. CAG039001

Order No. 97-36, Shipyard NPDES Permit No. CAG039001, in effect from October 15, 1997 to February 5, 2003 contained the following key requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The discharge of sewage (except as noted in the Basin Plan Waste Discharge Prohibitions) to San Diego Bay is prohibited;
- A. PROHIBITIONS … 5. The discharge of rubbish, refuse, debris, materials of petroleum origin (other than ship launch grease / wax) waste zinc plates, abrasives, primer, paint, paint chips, solvents, marine fouling organisms, and the deposition of such wastes at any place where they could eventually be discharged is prohibited. This pollution does not apply to the discharge of marine fouling organisms removed from unpainted, uncoated surfaces by underwater operations (see Prohibition 11). (Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals or dead fish deposited or caused to be deposited by man.);
- A. PROHIBITIONS … 8. Discharges of wastes and pollutants identified in Finding 2.a.i through 2.a.ix of this Order are prohibited. Discharges of wastes and pollutants not specifically identified in Finding 2.b through 2.e of this Order are prohibited.

  Finding 2 states the following: … a. Ship construction, modification, repair, and maintenance activities result or have the potential to result in discharges to San Diego Bay of wastes and pollutants which are likely to cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; cause or contribute to violation of an applicable water quality objective; and/or otherwise adversely affect the quality and/or beneficial uses of waters of the state and waters of the United States. Such discharges include: i. water contaminated with abrasive blast materials, paint, oils, fuels, lubricants, solvents, or petroleum; ii. hydroblast water; iii. tank cleaning water from tank cleaning to remove sludge and/or dirt; iv. clarified water from oil/water separation; v. steam cleaning water; vi. demineralizer / reverse osmosis brine; vii. floating drydock sump water when the drydock is in use as a work area or when the drydock is not in use as a work area but before the sump has been purged following such use; viii. oily bilge water; ix. contaminated ballast water; and x. the first flush of storm water runoff from high-risk areas. … b. Ship construction, modification, repair, and maintenance activities also result or have the potential to result in discharges to San Diego Bay of wastes and pollutants which pose less threat than those identified in Finding 2.a above. Such discharge included: i. vessel washdown water; ii. floating drydock submergence/emergence water; iii. graving dock flood water; iv. graving dock sump pump test water; v. shipbuilding ways flood water; vi. floating drydock sump water when the drydock is not in use as a work area after the sump has been purged following such use; vii. pipe and tank hydrostatic test water; viii. graving dock gate and wall leakage water; ix. shipbuilding ways gate and wall leakage and hydrostatic relief water; x. miscellaneous low-volume water; and xi. storm water runoff other than the first flush of storm water runoff from high-risk areas;

- B. DISCHARGE SPECIFICATIONS … 5. Waste discharges shall be essentially free of:
  a. Material that is floatable or will become floatable upon discharge;
  b. Settleable material or substances that may form sediments, which will degrade benthic communities or other aquatic life;
  c. Substances, which will accumulate to toxic levels in marine waters, sediments, or biota;
  d. Materials that result in aesthetically undesirable discoloration of receiving waters; and
  e. Substances that significantly decrease the natural light to benthic communities and other marine life;
- C. RECEIVING WATER LIMITATIONS … Discharges shall not cause or contribute to violation of the following receiving water limitations:
  1. There shall be no adverse impact on human health or the environment;
  2. There shall be no impairment of any beneficial use or violations of the applicable Basin Plan Water Quality Objectives (Attachment C) or any applicable State water quality control plan or policy;
  3. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded;

4. Natural light shall not be significantly reduced as the result of the discharge of waste;
5. The rate of deposition of inert solids and the characteristics of inert solids in sediments shall not be changed such that benthic communities are degraded;
6. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions;
7. The concentration of substances in marine sediments shall not be increased to levels that would degrade indigenous biota;
8. The concentration of organic materials in sediment shall not be increased to levels that would degrade marine life;
9. Substances shall not be present in the water column, sediments, or biota at concentrations that adversely affect beneficial uses or which will bioaccumulate to levels that are harmful to aquatic organisms, wildlife, or human health; and
10. The daily maximum chronic toxicity of waters of the United States shall not exceed 1 Toxic Unit Chronic (TUc), as determined using a standard test species and protocol approved by the Executive Officer; and

- ATTACHMENT C. STANDARD PROVISIONS … 22. Pollution, Contamination, Nuisance: The handling, transport, treatment, or disposal of waste or the discharge of waste to waters of the state in a manner which causes or threatens to cause a condition of pollution, contamination, or nuisance, as those terms are defined in CWC 13050, is prohibited.

2.6.5 Order No. R9-2003-0005, Shipyard NPDES Permit No. CA0109134

Order No. R9-2003-0005, Shipyard NPDES Permit No. CA0109134, in effect from February 5, 2003 to Present, contains the following key requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The discharge of sewage, except as noted in the Basin Plan Waste Discharge Prohibitions, to San Diego Bay is prohibited;
- A. PROHIBITIONS … 6. The discharge of rubbish, refuse, debris, materials of petroleum origin, waste zinc plates, abrasives, primer, paint, paint chips, solvents, and marine fouling organisms, and the deposition of such wastes at any place where they could eventually be discharged is prohibited. This prohibition does not apply to the discharge of marine fouling organisms removed from unpainted, uncoated surfaces by underwater operations and discharges that result from cleaning of floating booms that were installed for 'Force Protection' purposes (see Prohibition 10). (Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals deposited or caused to be deposited by man.);

- A. PROHIBITIONS … 8. The discharge or bypassing of untreated waste to San Diego Bay is prohibited. (This prohibition does not apply to non-contact cooling water, miscellaneous low volume water, and fire protection water streams, which comply with the requirements of this Order for elevated temperature waste discharges and which do not contain pollutants or waste other than heat.);
- B. DISCHARGE SPECIFICATIONS … 4. The following acute toxicity effluent limit applies to undiluted storm water discharges to San Diego Bay, that are associated with industrial activity: Acute toxicity: In a 96-hour static or continuous flow bioassay test, the discharge shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time, using a standard test species and protocol approved by the Regional Board;
- B. DISCHARGE SPECIFICATIONS … 9. Waste discharges shall be essentially free of:
  a. Material that is floatable or will become floatable upon discharge;
  b. Settleable material or substances that may form sediments, which will degrade benthic communities or other aquatic life;
  c. Substances, which will accumulate to toxic levels in marine waters, sediments, or biota;
  d. Materials that result in aesthetically undesirable discoloration of receiving waters; and
  e. Substances that significantly decrease the natural light to benthic communities and other marine life;
- C. RECEIVING WATER LIMITATIONS. Discharges shall not cause or contribute to violation of the following receiving water limitations:
  1. There shall be no adverse impact on human health or the environment;
  2. There shall be no impairment of any beneficial use or violations of the applicable Basin Plan Water Quality Objectives (Attachment C) or any applicable State water quality control plan or policy;
  3. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded;
  4. Natural light shall not be significantly reduced as the result of the discharge of waste;
  5. The rate of deposition of inert solids and the characteristics of inert solids in sediments shall not be changed such that benthic communities are degraded;
  6. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions;
  7. The concentration of substances in marine sediments shall not be increased to levels that would degrade indigenous biota;

8. The concentration of organic materials in sediment shall not be increased to levels that would degrade marine life; and
9. Substances shall not be present in the water column, sediments, or biota at concentrations that adversely affect beneficial uses or which will bioaccumulate to levels that are harmful to aquatic organisms, wildlife, or human health.

- ATTACHMENT D, STANDARD PROVISIONS … 22. Pollution, Contamination, Nuisance: The handling, transport, treatment, or disposal of waste or the discharge of waste to waters of the state in a manner which causes or threatens to cause a condition of pollution, contamination, or nuisance, as those terms are defined in CWC 13050, is prohibited.

2.6.6 Order No. 91-13-DWQ, NPDES Permit No. CAS000001, General Industrial NPDES Requirements for Storm Water Discharges

Order No. 91-13-DWQ, NPDES Permit No. CAS000001, in effect from November 4, 1992 to February 5, 1998 contained the following key narrative limitations that relate to the discussions contained herein:

- A. DISCHARGE PROHIBITIONS: … 3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance; and
- B. RECEIVING WATER LIMITATIONS. … 1. Storm water discharges to any surface or ground water shall not adversely impact human health or the environment.

2.7 NASSCO's Waste Discharges

NASSCO has (1) caused or permitted waste from its shipyard operations to be discharged to San Diego Bay in violation of waste discharge requirements; and (2) discharged or deposited waste where it was discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance.

NASSCO Shipyard discharges and NPDES Permit requirement violations are documented in the Regional Board records via discharger monitoring and spill reports (filed by NASSCO), citizen complaints, Regional Board inspection reports, and Regional Board Notices of Violation issued to NASSCO. These discharges are itemized in Tables 2-4 through 2-8, below.

Table 2-4. NASSCO Discharges from 1974 to 1979

Date	Description	Technical Report Reference[1]	Source	Citation[2]
March 6, 1976	Discharge of approximately 200 gallons of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 74-79, B. Provisions 1
June 25, 1976	Discharge of approximately 500 gallons of oily water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 74-79, B. Provisions 1
February 7, 1978	Discharge of trash to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 74-79, B. Provisions 1

[1] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.
[2] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

Table 2-5. NASSCO Discharges from 1979 to 1985

Date	Description	Technical Report Reference[1]	Source	Citation[2]
January 16, 1980	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	Citizen Complaint[3]	Order No. 79-63, B. Provisions 1
January 23, 1980	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 79-63, B. Provisions 1
February 11, 1982	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	Citizen Complaint[3]	Order No. 79-63, B. Provisions 1

[1] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.
[2] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.
[3] Anonymous citizen complaints constitute hearsay evidence and cannot alone support findings. However, the hearsay evidence is admissible to support findings of the Regional Board if corroborated by other evidence.

Table 2-6. NASSCO Discharges from 1985 to 1998

Date	Description	Technical Report Reference[1]	Source	Citation[2]
June 15, 1987	Discharge of lead to Bay from sacrificial anode.	Section 2.4 and 2.5	Citizen Complaint[3]	Order No. 85-05, D. Provisions 1
June 25, 1987	Discharge of a large amount of paint to Bay.	Section 2.4 and 2.5	Citizen Complaint[3]	Order No. 85-05, A. Prohibitions 2
November 30, 1987	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
February 29, 1988	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
March 2, 1988	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection; NASSCO Report[4]	Order No. 85-05, A. Prohibitions 2
February 27, 1989	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection; NASSCO Report[4]	Order No. 85-05, A. Prohibitions 2
May 31, 1989	Discharge of abrasive blast waste to Bay.	Section 2.4 and 2.5	RWQCB Inspection; NASSCO Report[4]	Order No. 85-05, A. Prohibitions 2
June 29, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
August 1, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
August 2, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
August 3, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay. Sample results in Section 2.3.5.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
August 7, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
August 8, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
August 14, 1989	Deposit of abrasive blast waste where it will probably be discharged to Bay. Sample results in Section 2.3.5.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
June 20, 1990	Discharge of oil to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
June 20, 1990	Deposit of paint and debris in sump where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
June 27, 1990	Discharge of 200 gallons of oily bilge wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
November 27, 1990	Deposit of abrasive blast waste and paint where it will probably be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
October 16, 1991	Deposit of abrasive blast waste and paint where it will probably be discharged to Bay. Sample results in Section 2.3.5.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
December 10, 1991	Discharge of 100 gallons of wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 27, 1992	Deposit of abrasive blast waste and paint where it will probably be discharged to Bay. Sample results in Section 2.3.5.	Section 2.4 and 2.5	RWQCB Inspection	Order No. 85-05, A. Prohibitions 2
April 22, 1992	Discharge of 30 gallons of waste oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 11, 1992	Discharge of approximately 10 gallons of waste (floor cement grindings) to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
September 28, 1992	Discharge of approximately 25 gallons of wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
September 29, 1992	Discharge of unknown quantity of shredded document slurry to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
October 28, 1992	Discharge of 1,500 to 2,000 gallons of sewage wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
December 19, 1992	Discharge of less than 1 gallon diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 25, 1993	Discharge of ½ gallon oily bilge water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 1, 1993	Discharge of about 100 gallons of oily wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
February 2, 1993	Discharge of about 100 gallons of oil and water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 11, 1993	Discharge of about 1,000 gallons raw sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
March 22, 1993	Discharge of less than 250 pounds abrasive blast waste (copper slag blasting material) to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
March 31, 1993	Discharge of 8 - 10 gallons of bilge wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
April 30, 1993	Discharge of less than 1/2 gallon of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 8, 1993	Discharge of 10 gallons spent hydroblast waste to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
October 20, 1993	Discharge of 60 to 100 gallons of treated sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
November 24, 1993	Discharge of 5 gallons of diesel oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
November 30, 1993	Discharge of less than 5 gallons of oily wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
December 14, 1993	Discharge of 5 gallons of bilge wastewater /petroleum to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
December 15, 1993	Discharge of between 250 and 400 gallons of diesel #2 fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
January 23, 1994	Discharge of approximately 2 gallons of gasoline to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 24, 1994	Discharge of 5 gallons of diesel oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 24, 1994	Discharge of 1-quart of lube oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 11, 1994	Discharge of 300 to 400 gallons of oily wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 22, 1994	Discharge of less than one pint of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
June 10, 1994	Discharge of unknown quantity of oily bilge wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
November 7, 1994	Discharge of 2 to 5 gallons of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
December 5, 1994	Discharge of approximately 1 quart of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 12, 1995	Discharge of an estimated 150 gallons of NR 1 marine diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
April 8, 1995	Discharge of 15 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
June 9, 1995	Discharge of various unpermitted discharges to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2 & D. Provisions 1

Date	Description	Technical Report Reference[1]	Source	Citation[2]
July 17, 1995	Discharge of 5 to 10 gallons of water and diesel oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
August 25, 1995	Discharge of 1 pint of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 2, 1995	Discharge of an estimated 2 gallons of oily water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 16, 1995	Discharge of an estimated 10 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
November 15, 1995	Discharge of 1 quart of transmission fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
November 20, 1995	Discharge of less than 1 pint of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
December 3, 1995	Discharge of 2 to 5 gallons of oil to Bay.	Section 2.4 and 2.5	US Navy Spill Report	Order No. 85-05, A. Prohibitions 2
January 17, 1996	Discharge of 1 to 2 gallons of T68 flushing oil to Bay.	Section 2.4 and 2.5	MSO San Diego Spill Report	Order No. 85-05, A. Prohibitions 2
February 5, 1996	Discharge of 1 pint of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
April 16, 1996	Discharge of 5 gallons of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
May 19, 1996	Discharge of less than 1 gallon of lube oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
June 13, 1996	Discharge of less than 5 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
July 20, 1996	Discharge of less than 1 pint of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
August 29, 1996	Discharge of 1 pint of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 5, 1996	Discharge of 1 gallon of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 27, 1996	Discharge of less than 5 gallons of jet fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 30, 1996	Discharge of 1 gallon of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
October 3, 1996	Discharge of 1 pint of turpentine to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
December 2, 1996	Discharge of ½ to 1 gallon hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 14, 1997	Discharge of 1 pint of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
January 19, 1997	Discharge of less than 2 pounds copper slag to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
February 18, 1997	Discharge of 1 quart petroleum to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
April 5, 1997	Discharge of 10 to 15 gallons of red dye diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
May 19, 1997	Discharge of less than 1 quart of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
May 30, 1997	Discharge of less than 1 gallon of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
June 25, 1997	Discharge of unknown quantity of process wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, D. Provisions 1
September 17, 1997	Discharge of approximately 2 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 17, 1997	Discharge of less than one quart JP5 jet fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2
September 29, 1997	Discharge of 20 gallons of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 85-05, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
June 30, 1998	For failure to sufficiently clean Graving Dock before flooding, and failure to properly maintain and store equipment and failure to prevent deposition or discharge of refuse, rubbish, materials of petroleum origin, spent abrasives, paint, paint chips, or marine fouling organisms at a place where they could be transported to San Diego Bay and failure to give the Regional Board notice of NASSCO's intent to flood the Dry Dock (i.e. Graving Dock) at least 48 hours before beginning the flooding.	Section 2.4 and 2.5	RWQCB NOV Letter to NASSCO	Order No. 85-05, A. Prohibitions 2 & D. Provisions 11

[1] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[2] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

[3] Anonymous citizen complaints constitute hearsay evidence and cannot alone support findings. However, the hearsay evidence is admissible to support findings of the Regional Board if other evidence can corroborate it.

[4] NASSCO Letter Report dated March 7, 1989.

Table 2-7. NASSCO Discharges from 1997 to 2003

Date	Description	Technical Report Reference[1]	Source	Citation[2]
November 26, 1997	Discharge of between 1 pint and 1 quart of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 14, 1998	Discharge of less than 4 ounces of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 15, 1998	Discharge of 50 gallons of oily wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 22, 1998	Discharge of 1 pint of paint to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
February 3, 1998	Discharge of at less than 50 gallons of hydroblast water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
February 9, 1998	Discharge of at least 2 gallons of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
March 17, 1998	Discharge of 2 gallons of oily water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
April 1, 1998	Discharge of 1 to 2 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
April 7, 1998	Discharge of about 1 gallon diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
April 21, 1998	Discharge of 175 gallons of 3% AFFF to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
April 27, 1998	Discharge of less than 1 pint of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
June 17, 1998	Deposit of oil drips, abrasive grit & other material where it could be discharged to Bay.	Section 2.4 and 2.5	RWQCB Inspection Report	Order No. 97-36, A. Prohibitions 5
January 8, 1999	Discharge of less than 1 gallon of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 21, 1999	Discharge of less than 1/2 gallon of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
March 4, 1999	Discharge of between 1 pint and 1 quart of fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
June 16, 1999	Discharge of 20 to 30 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
July 13, 1999	Discharge of less than 50 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
August 19, 1999	Discharge of 10 gallons of cooking fat to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 27, 1999	Discharge of 1/2 pint of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
September 10, 1999	Discharge of 2 gallon of hydraulic fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
September 22, 1999	Discharge of an unknown quantity of dust particulate material to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
October 15, 1999	Discharge of 1/2 gallon of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
November 4, 1999	Discharge of less than 1 pint of paint to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
November 18, 1999	Discharge of less than 1 pint of paint to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
November 29, 1999	Discharge of less than 2 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
December 2, 1999	Discharge of 30 to 50 gallons of Turbine Lube Oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
December 17, 1999	Discharge of 1 pint of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 31, 2000	Discharge of 50 gallons of marine diesel oil discharged to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
February 18, 2000	Discharge of 50 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
March 27, 2000	Discharge of less than 1 gallon of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
June 6, 2000	Discharge of 1 to 2 gallons of oily wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
July 26, 2000	Discharge of several drops of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 4, 2000	Discharge of small amount of paint chips to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 7, 2000	Discharge of less than 1 gallon of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
September 14, 2000	Discharge of 1 pint of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
November 7, 2000	Discharge of less than 1 gallon of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
November 13, 2000	Discharge of less than 1 gallon of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
November 15, 2000	Discharge of 50 gallons of steam condensate to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
December 12, 2000	Discharge of ½ pint of yellow/green dye to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
December 20, 2000	Discharge of 200 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
January 2, 2001	Discharge of 2 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 3, 2001	Discharge of 1 quart of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 8, 2001	Discharge of ½ pint of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
January 12, 2001	Discharge of 30 gallons of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
February 24, 2001	Discharge of small quantity of paint dust to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
March 28, 2001	Discharge of less than 5 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 14, 2001	Discharge of small quantity of wood dust to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
May 15, 2001	Discharge of less than 8 ounces of paint chips to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
May 17, 2001	Discharge of small quantity of copper slag dust to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 18, 2001	Discharge of unknown quantity of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 21, 2001	Discharge of less than 1 quart of oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 22, 2001	Discharge of less than 50 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
May 22, 2001	Discharge of small quantity of paint chips to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 24, 2001	Discharge of shop-vac contents to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
May 24, 2001	Discharge of small quantity of chalky substance to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
May 24, 2001	Discharge of small quantity of fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
May 25, 2001	Discharge of small quantity of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
July 3, 2001	Discharge of less than 10 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
July 6, 2001	Discharge of 10 gallons of wastewater to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
August 18, 2001	Discharge of approximately 100 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
November 7, 2001	Discharge of less than one gallon of paint to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
September 26, 2001	Discharge of less than 5 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
January 4, 2002	Discharge of approximately 1/2 gallon spent blast grit to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
February 13, 2002	Discharge of approximately ¼ cup of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
April 2, 2002	Discharge of approximately 25 gallons of oily water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
April 6, 2002	Discharge of less than 5 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
May 31, 2002	Discharge of unknown quantity of paint overspray to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibition 5
July 2, 2002	Discharge of approximately 1 pint of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 5, 2002	Discharge of an estimated 3 gallons of oily water to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 13, 2002	Discharge of an estimated 120 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
August 23, 2002	Discharge of an estimated 2 gallons of diesel fuel to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
September 6, 2002	Discharge of unspecified large quantity of AFFF to Bay.	Section 2.4 and 2.5	RWQCB Violation Letter	Order No. 97-36, A. Prohibitions 8
September 8, 2002	Discharge of an estimated 1/2 cup of lube oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
September 12, 2002	Discharge of less than 1 pint of lube oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 5
September 17, 2002	Discharge of less than 1,000 gallons of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
September 17, 2002	Discharge of estimated 75 gallons of AFFF discharged to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 8
December 6, 2002	Discharge of estimated less than 1 gallon of sewage to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2
January 7, 2003	Discharge of estimated 1 quart of sewage discharged to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. 97-36, A. Prohibitions 2

[1] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[2] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

Table 2-8. NASSCO Discharges from 2003 to 2005

Date	Description	Technical Report Reference[1]	Source	Citation[2]
February 10, 2003	Discharge of 500 gallons of raw sewage to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 2
February 24, 2003	Discharge of 3 gallons of hydraulic oil to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. R9-2003-0005, A. Prohibitions 6
April 17, 2003	Discharge of 100 gallons of cleaning fluid to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 8
June 5, 2003	Discharge of approximately 10 gallons of hydroblast wastewater to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
June 6, 2003	Discharge of approximately 5 gallons of hydroblast wastewater to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
June 6, 2003	Discharge of approximately 2 gallons of hydroblast wastewater to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
June 12, 2003	Discharge of 5 gallons of hydroblast wastewater to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
June 12, 2003	Discharge of 25 gallons of sewage to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 2
June 23, 2003	Discharge of 50 gallons of sewage to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 2
June 30, 2003	Discharge of 1 cup of paint chips to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
August 15, 2003	Discharge of approximately ¼ cup of spray paint to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. R9-2003-0005, A. Prohibitions 6

Date	Description	Technical Report Reference[1]	Source	Citation[2]
September 2, 2003	Discharge of less than 1 gallon of sewage discharged to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 2
October 24, 2003	Discharge of unknown quantity of substance causing oily sheen to Bay.	Section 2.4 and 2.5	RWQCB Enforcement Letter	Order No. R9-2003-0005, A. Prohibitions 6
December 2, 2003	Discharge of unknown quantity of paint chips to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. R9-2003-0005, A. Prohibitions 6
November 29, 2004	Discharge of small amount of hydraulic fluid to Bay.	Section 2.4 and 2.5	NASSCO Spill Report	Order No. R9-2003-0005, A. Prohibitions 6
January 20, 2005	Violations of stormwater toxicity effluent limitations on February 22, 2004 and February 26, 2004.	Section 2.4 and 2.5	RWQCB Notice of Violation	Order No. R9-2003-0005, B. Discharge Specifications 4

[1] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[2] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

2.8 NASSCO's Storm Water Monitoring for Shipyard NPDES Requirements

Since 1985, NASSCO's Shipyard NPDES Permits have included Discharge Specifications and Receiving Water Limitations, which established a narrative limit on discharge pollutant concentrations to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

While operating under various Shipyard NPDES Permits, NASSCO discharged constituents at levels that are elevated compared to levels established by the California Toxics Rule (CTR) for saltwater.[32] The U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included as numerical effluent limitations in any of the Shipyard NPDES Permits issued to NASSCO. However, the numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in a water body is detrimental to its beneficial uses. By comparing CTR values with pollutant levels in historical discharges, the Regional Board is able to determine which discharges *may* have contributed to toxic chemical concentrations in marine water, marine life, and sediment at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an *elevated probability* that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges *did* cause toxic chemical concentrations in marine water, marine life, and sediment, and/or *did* contribute to the present condition of pollution at the Shipyard Sediment Site, there exists a Shipyard NPDES violation.

While NASSCO's various Shipyard NPDES Requirements[33] did not provide specific numerical limitations for all possible chemicals, the Regional Board did require that discharges from NASSCO not cause a violation of the key requirements, described in Section 2.6, above. Monitoring reports submitted by NASSCO during the years 1991 and 2002 through 2004 indicate that elevated levels of copper, nickel, and zinc were present in storm water discharged from the NASSCO site. Specific discharges are presented in Tables 2-9 through 2-11, below.

[32] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

[33] Order No. 85-05, Shipyard NPDES Permit No. CA0107671, Order No. 97-36, Shipyard NPDES Permit No. CAG039001, and Order No. R9-2003-0005, Shipyard NPDES Permit No. CA0109134

Table 2-9. Discharge Sample Results Above CTR Criteria Occurring from 1985 to 1997

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 10, 1991	Zinc	6.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Connection	Lab Report of NASSCO Sample	Order No. 85-05, B. Discharge Specifications 2b and 2c, and C. Receiving Water Limitations 5a

[1] 40 CFR 131.38
[2] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.
[3] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

Table 2-10. Discharge Sample Results Above CTR Criteria Occurring from 1997to 2003

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
September 11, 2002	Copper	0.0208 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Ship Bldg Ways 4 Hydro-static relief	NASSCO Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
September 11, 2002	Zinc	0.0841 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Ship Bldg Ways Hydro-static relief	NASSCO Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10

[1] 40 CFR 131.38

[2] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[3] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

Table 2-11. Discharge Sample Results Above CTR Criteria Occurring from 2003 to 2004

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 26, 2003	Copper	0.00534 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 26, 2003	Copper	0.00351 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 26, 2003	Zinc	0.362 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 26, 2003	Copper	0.01725 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 26, 2003	Copper	0.0459 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 26, 2003	Zinc	0.331 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 21, 2003	Copper	0.00613 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 21, 2003	Copper	0.00381 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 21, 2003	Zinc	0.27 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 21, 2003	Copper	0.0146 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 21, 2003	Zinc	0.127 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 23, 2003	Copper	0.00938 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 23, 2003	Copper	0.0131 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 23, 2003	Zinc	0.153 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 23, 2003	Copper	0.00371 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 23, 2003	Zinc	0.225 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 23, 2003	Copper	0.00726 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 21, 2003	Copper	0.00975 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 21, 2003	Nickel	0.011 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 21, 2003	Copper	0.00432 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
May 21, 2003	Copper	0.006205 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
June 13, 2003	Copper	0.0067 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
June 13, 2003	Copper	0.00726 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
June 13, 2003	Copper	0.0045 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 6, 2003	Copper	0.00468 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
August 6, 2003	Copper	0.0046 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3 HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 6, 2003	Copper	0.00478 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4 HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 9, 2003	Copper	0.005 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 9, 2003	Copper	0.0503 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 9, 2003	Nickel	0.00861 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 9, 2003	Zinc	0.126 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 9, 2003	Copper	0.00557 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 25, 2003	Copper	0.0068 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock HR	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 25, 2003	Copper	0.00759 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 25, 2003	Copper	0.0168 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 25, 2003	Nickel	0.0187 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock Flood Water	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
December 12, 2003	Copper	0.00405 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
December 12, 2003	Copper	0.00541 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
December 12, 2003	Copper	0.0037 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 7, 2004	Copper	0.00603 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 7, 2004	Copper	0.00623 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 7, 2004	Copper	0.00522 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 4, 2004	Copper	0.0305 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 4, 2004	Copper	0.00597 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2004	Copper	0.00837 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 17, 2004	Copper	0.00379 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2004	Nickel	0.00923 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2004	Copper	0.00494 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2004	Copper	0.00552 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 21, 2004	Copper	0.00313 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 21, 2004	Copper	0.0225 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 21, 2004	Zinc	0.237 mg/L	0.081 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 21, 2004	Copper	0.00317 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 17, 2004	Copper	0.0063 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 17, 2004	Nickel	0.00962 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
May 17, 2004	Copper	0.00664 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 17, 2004	Nickel	0.0107 mg/L	0.0082 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 17, 2004	Copper	0.0155 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
June 9, 2004	Copper	0.00767 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
June 9, 2004	Copper	0.00793 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
July 12, 2004	Copper	0.00468 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 12, 2004	Copper	0.00781 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 12, 2004	Copper	0.00674 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 12, 2004	Copper	0.0037 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 23, 2004	Copper	0.00383 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
August 23, 2004	Copper	0.00743 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 23, 2004	Copper	0.00321 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
September 13, 2004	Copper	0.00392 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
September 13, 2004	Copper	0.00733 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 13, 2004	Copper	0.00483 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 13, 2004	Copper	0.00319 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 13, 2004	Copper	0.00642 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November, 12, 2004	Copper	0.00415 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Fire Protection	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November, 12, 2004	Copper	0.00318 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Graving Dock	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November, 12, 2004	Copper	0.0068 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 3	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November, 12, 2004	Copper	0.00457 mg/L	0.0031 mg/L	Section 2.4 and 2.5	Storm Water Shipbuilding Ways 4	NASSCO Monitoring Report	Order No. R9-2003-0005, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

[1] 40 CFR 131.38

[2] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[3] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

2.9 NASSCO's Storm Water Monitoring for the General Industrial NPDES Requirements for Storm Water Discharges

From 1992 until 2003, NASSCO's General Industrial NPDES Requirements for Storm Water Discharges included Discharge Prohibitions and Receiving Water Limitations, which set a narrative limit on discharge pollutant concentrations to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

While subject to regulation under the General Industrial NPDES Requirements for Storm Water Discharges, NASSCO discharged pollutants at elevated levels compared to levels established by the California Toxics Rule (CTR) for saltwater.[34] The U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included as numerical effluent limitations in any of the Industrial NPDES Requirements issued to NASSCO. However, the numerical values in the CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in a water body is detrimental to its beneficial uses. By comparing CTR values with pollutant levels in historical discharges, the Regional Board is able to determine which discharges *may* have contributed to toxic chemical concentrations in marine water, marine life, and sediment at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an *elevated probability* that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges *did* cause toxic chemical concentrations in marine water, marine life, and sediment, and/or *did* contribute to the present condition of pollution at the Shipyard Sediment Site, there exists an Industrial NPDES Requirements violation.

While NASSCO's Industrial NPDES Requirements did not provide specific numerical limitations for all possible chemicals, the Regional Board did require that discharges from NASSCO not cause a violation of discharge prohibitions and receiving water limitations described in Section 2.6.6, above. Monitoring reports submitted by NASSCO during the years 1992 through 1998, pursuant to the General Industrial NPDES Requirements for storm water discharges, indicate that elevated levels of chromium, copper, lead, nickel, and zinc have been present in storm water discharged from the NASSCO site when compared to levels established by the CTR for saltwater. The specific discharges above the CTR are cited in Table 2-12, below.

[34] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

Table 2-12. Discharges Above CTR Value Occurring from 1992 to 1998

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 1993	Chromium	0.11 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Chromium	0.22 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.40 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-1	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.06 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-2	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.37 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-3	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 1993	Copper	0.43 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-4	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.43 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.31 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	2.2 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Copper	0.37 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-8	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 1993	Lead	0.11 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-3	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Lead	0.07 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-4	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Lead	0.06 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Lead	0.05 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Lead	1.0 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 1993	Nickel	0.19 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-4	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Nickel	0.15 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	2.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-1	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	1.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-2	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	2.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-3	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 1993	Zinc	4.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-4	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	5.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	5.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	10.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 18, 1993	Zinc	4.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-8	NASSCO 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Chromium	0.1 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Chromium	0.2 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.09 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-2	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.47 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-3	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	6.1 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Copper	1.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	1.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.16 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-8	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Lead	0.77 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Nickel	20.0 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Nickel	0.3 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Nickel	0.07 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	1.5 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-1	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	10.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-2	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	1.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-3	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Zinc	2.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-5	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	2.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-6	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	9.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-7	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	4.3 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-8	NASSCO 1993-1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 11, 1994	Chromium	0.06 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 11, 1994	Copper	0.97 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 11, 1994	Lead	0.07 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 11, 1994	Nickel	0.28 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 11, 1994	Zinc	11.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Chromium	0.05 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 10, 1994	Chromium	0.06 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Copper	1.9 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Copper	0.92 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Lead	0.15 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Lead	0.12 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 10, 1994	Nickel	0.10 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Nickel	0.07 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Zinc	9.14 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 10, 1994	Zinc	14.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1994-1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Copper	0.20 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 21, 1995	Copper	0.08 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Copper	0.29 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Copper	0.21 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Copper	0.42 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Lead	0.12 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 21, 1995	Nickel	0.11 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Zinc	1.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Zinc	0.84 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Zinc	1.45 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 21, 1995	Zinc	2.5 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 21, 1995	Zinc	2.95 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1995-1996 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	1.2 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	0.39 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	0.86 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	0.46 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 30, 1996	Copper	0.56 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	1.1 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Copper	0.09 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-08	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Lead	0.14 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Lead	0.2 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 30, 1996	Lead	0.11 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Lead	0.38 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.38 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.28 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.28 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 30, 1996	Nickel	0.31 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.21 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.14 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Nickel	0.25 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-08	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Zinc	7.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 30, 1996	Zinc	5.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Zinc	7.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Zinc	7.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Zinc	10.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 30, 1996	Zinc	12.3 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 30, 1996	Zinc	14.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-08	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Chromium	0.06 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Chromium	0.09 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Chromium	0.24 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Chromium	0.07 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 21, 1996	Copper	2.1 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Copper	0.89 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Copper	0.94 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Copper	0.46 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Copper	1.2 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 21, 1996	Nickel	1.2 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Nickel	0.35 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Nickel	0.70 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Nickel	0.48 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Nickel	0.79 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 21, 1996	Zinc	11.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Zinc	6.5 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Zinc	8.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Zinc	16.5 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 21, 1996	Zinc	9.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 2, 1997	Chromium	0.2 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Chromium	0.2 mg/L	0.05 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	0.98 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	0.57 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	0.99 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 2, 1997	Copper	0.53 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	0.76 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	2.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Copper	0.91 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Lead	1.1 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 2, 1997	Nickel	0.2 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Nickel	0.05 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Nickel	0.05 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Nickel	0.08 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Nickel	0.05 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 2, 1997	Nickel	0.17 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Nickel	0.09 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	6.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	9.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	6.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 2, 1997	Zinc	8.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	12.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	14.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 2, 1997	Zinc	13.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.49 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Copper	0.24 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	1.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.88 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.81 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-3	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.37 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Copper	0.49 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 2-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.32 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 2-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.23 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 2-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.76 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 3-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.46 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 5-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Copper	0.25 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 5-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	1.4 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 7-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.11 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.61 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.4 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Copper	0.84 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.74 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.71 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.55 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.80 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Copper	0.57 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.19 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.51 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.64 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Copper	0.11 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Lead	0.10 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Lead	0.11 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 2-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Lead	0.17 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 3-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Lead	0.46 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 7-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Lead	0.17 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Lead	0.24 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.43 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.62 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW 06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.48 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	1.2 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Nickel	0.43 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-3	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.43 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.66 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 2-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.52 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 2-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.72 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 2-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Nickel	0.57 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 3-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.95 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 5-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.95 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 5-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	1.0 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 7-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.78 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Nickel	0.74 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.6 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.55 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.36 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.21 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Nickel	0.48 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.67 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.07 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.76 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.49 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Nickel	0.74 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Nickel	0.58 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	1.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	2.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW 06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	2.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Zinc	2.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	1.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-3	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	0.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	7.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 2-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	1.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 2-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Zinc	5.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 2-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	3.3 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 3-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	2.0 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 5-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	3.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 5-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	5.3 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 5-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Zinc	4.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	2.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	1.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	5.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	9.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Zinc	5.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	4.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	3.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	5.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	1.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 13, 1997	Zinc	4.4 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	5.8 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 13, 1997	Zinc	0.95 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	2.2 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.27 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Copper	0.34 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.11 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.08 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.19 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.26 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Copper	0.10 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.72 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.28 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.5 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.16 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Copper	0.21 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.60 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.2 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.0 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Copper	0.65 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.16 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.6 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.13 mg/L	0.0031 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.26 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Lead	0.38 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.17 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.12 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.13 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.92 mg/L	0.0081 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Nickel	0.22 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.27 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.28 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.22 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.32 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Nickel	0.25 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.15 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.33 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.39 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.13 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Nickel	0.33 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.20 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.28 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.71 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.32 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Nickel	0.21 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.36 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.21 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.24 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Nickel	0.35 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Nickel	0.19 mg/L	0.0082 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	4.5 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-01	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-02	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-03	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-05	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Zinc	0.48 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-06	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	0.93 mg/L	0.081 mg/L	Section 2.4 and 2.5	SW-07	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	0.97 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	0.80 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-4	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SWDS-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Zinc	1.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-1	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	4.3 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-2	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	0.79 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-5	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.1 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-6	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	5.9 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-7	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Zinc	1.6 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-8	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	3.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-9	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	3.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-10	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	2.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-11	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.2 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-12	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Zinc	4.7 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-14	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 25, 1998	Zinc	0.68 mg/L	0.081 mg/L	Section 2.4 and 2.5	SD 9-15	NASSCO 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

[1] 40 CFR 131.38

[2] Reference to Section 2.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 2.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 2.4 and 2.5.

[3] The cited waste discharge requirement(s) can be found in Section 2.6 of this Technical Report.

2.10 Prior History of Enforcement Actions for Violations of NPDES Requirements

2.10.1 Administrative Civil Liability Orders

On May 22, 1989, the Regional Board issued Complaint No. 89-42 Administrative Civil Liability to NASSCO, for the discharge of spent abrasive waste from a floating drydock to San Diego Bay and to have operated its graving dock in a manner that was in violation of Order No. 85-05, NPDES No. CA0107671. NASSCO elected to waive a hearing and accepted liability for the discharge of cooling water contaminated with wastes from the hull and freeboard abrasive blasting operations to San Diego Bay, failing to prevent miscellaneous water flows from coming in contact with sand blast residue in the graving dock, and the discharge of slurry blast wastes to San Diego Bay. NASSCO agreed to pay a total civil penalty of $10,000.

On January 30, 2001, the Regional Board issued Complaint No. 2001-24 Administrative Civil Liability to NASSCO, for violations of the storm water runoff requirements of its NPDES permit. NASSCO sampled twenty-one discharge points on February 12, 2000, with all samples results showing toxic responses that violated the storm water discharge requirements of Order No. 97-36, NPDES permit No. CAG039001. The Regional Board determined that each sample failure was a violation and assessed a civil liability fine of $135,801 against NASSCO.

2.11 Industry-wide Historical Operational Practices

In November of 1997, the U.S. Environmental Protection Agency released a study titled "EPA Office of Compliance Sector Notebook Project: PROFILE OF SHIPBUILDING AND REPAIR INDUSTRY." According to the 1995 Toxic Release Inventory (TRI) data, the reporting shipbuilding and repair facilities released and transferred 39 different TRI chemicals for a total of approximately 6.5 million pounds of pollutants during calendar year 1995. These releases and transfers were dominated by volatile organic compounds (VOCs) and metal-bearing wastes, approximately 52 percent and 48 percent respectively (U.S. EPA, 1997c).

Releases to the air, water, and land have accounted for 37 percent (2.4 million pounds) of the shipyard's total reportable chemicals. Of these releases, over 98 percent were released to the air from fugitive (74.6 percent; 1,778,818 pounds) or point (24.1 percent; 574,097 pounds) sources, while approximately 1.2 percent (29,479 pounds) was release directly to water (U.S. EPA, 1997c). However, a significant percentage of the total pollutants released as fugitive air or point air releases end up in the water, adding significantly to the 1.2 percent which is released directly to water.

VOCs accounted for about 86 percent of the shipyard's reported TRI releases. Xylenes, n-butyl alcohol, toluene, methyl ethyl ketone, and methyl isobutyl ketone account for about 65 percent of the industry's reported releases. These organic compounds are typically found in solvents that were used extensively by the industry in thinning paints and for cleaning and degreasing metal parts and equipment (U.S. EPA, 1997c).

The remainder of the releases was primarily metal-bearing wastes. Copper, zinc, and nickel-bearing wastes accounted for about 14 percent of the industry's reported releases. These pollutants were released primarily as fugitive emissions during metal plating operations and as overspray in painting operations and could also have been released as fugitive dust emissions during blasting operations (U.S. EPA, 1997c).

3. Finding 3: BAE Systems San Diego Ship Repair, Inc., Formerly Southwest Marine, Inc. (Southwest Marine)

Southwest Marine owns and operates a ship repair, alteration, and overhaul facility on approximately 27 acres of tidelands property leased from the San Diego Unified Port District (SDUPD) on the eastern waterfront of central San Diego Bay at the foot of Sampson Street in San Diego. Southwest Marine has conducted shipyard operations over San Diego Bay waters or very close to the waterfront since 1979. Shipyard facilities operated by Southwest Marine over the years have included concrete platens used for steel fabrication, floating dry docks, and five piers. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. Southwest Marine BAE Systems San Diego Ship Repair, Inc. has (1) caused or permitted pollutants waste from its shipyard operations, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH), to be discharged into San Diego Bay in violation of waste discharge requirements prescribed by the Regional Board.; and NASSCO also (2) discharged or deposited waste where it was discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH).these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from Southwest Marine's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations Southwest Marine BAE Systems San Diego Ship Repair, Inc. is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

From 1979 to the present, Southwest Marine, Inc. and its successor BAE Systems San Diego Ship Repair, Inc., hereinafter collectively referred to as BAE Systems, have owned and operated a ship repair, alteration, and overhaul facility on approximately 39.6 acres of tidelands property on the eastern waterfront of central San Diego Bay. The facility, currently referred to as BAE Systems San Diego Ship Repair, is located on land leased from the San Diego Unified Port District (SDUPD) at 2205 East Belt Street, foot of Sampson Street in San Diego, San Diego County, California. Shipyard facilities operated by BAE Systems over the years have included concrete platens used for steel fabrication, two floating dry docks, five piers, and two marine railways. An assortment of waste has been generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse.

3.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that Southwest Marine, Inc. and its successor BAE Systems should be named as dischargers in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

3.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;

4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

3.3 BAE Systems Owns and Operates the San Diego Ship Repair Facility

3.3.1 Facility Description

From 1979 to the present, Southwest Marine, Inc. and its successor BAE Systems San Diego Ship Repair, Inc.[35], hereinafter collectively referred to as BAE Systems, have owned and operated a ship repair, alteration, and overhaul facility on approximately 39.6 acres of tidelands property on the eastern waterfront of central San Diego Bay. The facility is located on land leased from the San Diego Unified Port District (SDUPD) at 2205 East Belt Street, foot of Sampson Street in San Diego, San Diego County, California. The facility covers approximately 39.6 acres of tidelands property, leased from the San Diego Unified Port District from 1979 to the present. The land portion and offshore area of the lease includes approximately 23 acres and 16.6 acres, respectively. BAE Systems' primary business has historically been ship repair and maintenance for the U.S. Navy and commercial customers.

Ship repair facilities at BAE Systems have historically included five piers, two floating dry docks and two marine railways, which, together with cranes, enable ships to be launched or repaired. The basic purpose of the dry dock is to separate the vessel from the bay to provide access to parts of the ship normally underwater. The piers are used to support berthed vessels that are undergoing maintenance and repair operations as well as berthing barges used to house vessel crews while ship repairs are being conducted. Because dry dock space is limited and expensive, many operations are conducted pier side. Marine railways are used to wheel vessels out of water (also called dry berthing a vessel). Activities conducted on dry berthed vessels are similar to those conducted in dry docks, but usually on a much smaller scale. The marine railways, located between Piers 1 and 2, were removed in 1998.

[35] BAE Systems San Diego Ship Repair, Inc. acquired Southwest Marine, Inc. on June 28, 2005.

On-shore facilities also included an abrasive blasting building and a paint spray booth area located at the foot of Pier 3 on the southeast section of the facility. On the northern end of the facility is an area used for steam cleaning/pressure washing of vehicles and equipment. This area includes a sump where the effluent is collected and drained to a three-stage clarifier that is connected to the Metropolitan Sanitary Sewer System. Other shore-side facilities include manufacturing and storage areas to support ship repair operations and material staging. Material staging is managed by zones for incoming and outgoing material to and from ships and shops.

BAE Systems manages a solid waste reclamation and recycling area, located at the foot of the gantry crane tracks adjacent to Belt Street, south of Building 8. The solid waste and recycling area segregates, consolidates, reclaims, recycles, and disposes municipal solid waste that is typically generated by shipyard activities. These wastes include metals, wood, and paper/cardboard. A hazardous waste reclamation facility, located west of the solid waste reclamation and recycling area, handles the spent abrasives, paint wastes, oil wastes, oil-contaminated debris, and miscellaneous chemicals removed from ships.

3.3.2 Activities Conducted by BAE Systems

Ship modification, repair, and maintenance activities at the BAE Systems facility have historically encompassed a large variety of activities including, but not limited to, application of paint systems; installation and repair of a large variety of mechanical, electrical, and hydraulic systems and equipment; repair of damaged vessels; removal and replacement of expended/failed paint systems; and provision of entire utility/support systems to ships (and crews) during repair.

These activities involve a multitude of industrial processes, many of which have been conducted over San Diego Bay waters or very close to the waterfront. As a result of these processes, an assortment of wastes has been generated including paint chips, abrasive grit, solvents, materials of petroleum origin, and heat. The industrial processes at the BAE Systems facility included the following:

- **Surface Preparation and Paint Removal**. Methods of surface preparation and paint removal include dry abrasive blasting, wet abrasive or slurry blasting, hydroblasting, and chemical paint stripping;
- **Paint Application**. After preparation, surfaces are painted. Most painting occurs in a dry dock and involves the ship hull and internal tanks. Painting is also conducted in other locations throughout the shipyard including piers and berths. Paint application is accomplished by way of air or airless spraying equipment and is a major activity at BAE Systems;

- **Tank Cleaning**. Tank cleaning operations use steam to remove dirt and sludges from internal tanks, particularly fuel tanks and bilges. Detergents, cleaners, and hot water may be injected into the steam supply hoses. BAE Systems reports that wastewater generated has typically been removed and disposed of at an on-site treatment facility;
- **Mechanical Repair/Maintenance/Installation**. A variety of mechanical systems and machinery require repair, maintenance, and installation;
- **Structural Repair/Alteration/Assembly**. Structural repair, alteration, and assembly generally involve welding, cutting, and fastening of steel plates or assembly blocks and other industrial processes;
- **Integrity/Hydrostatic Testing**. Hydrostatic or strength testing, and flushing are conducted on hulls, tanks, or pipe repairs. Integrity testing is also conducted on new systems during ship construction phases;
- **Paint Equipment Cleaning**. All air and airless paint spraying equipment is typically cleaned following use. Paint equipment cleaning is a major producer of waste, including solvents, thinners, and paint wastes, and sludges;
- **Engine Repair/Maintenance/Installation**. Automotive repair, ship engine repair, maintenance, and installation generate waste oils, solvents, fuels, batteries, and filters;
- **Steel Fabrication and Machining**. Fabrication of engine and ship parts occurs at BAE Systems. Cutting oils, fluids, and solvents are used extensively including acetone, methyl ethyl ketone (MEK) and chlorinated solvents;
- **Electrical Repair/Maintenance/Installation**. The repair, maintenance, and installation of electrical systems involve the use of numerous hazardous materials including trichlorethylene, trichloroethane, methylene chloride, and acetone;
- **Hydraulic Repair/Maintenance/Installation**. The repair, maintenance, and installation of hydraulic systems involve the replacement of spent hydraulic oils;
- **Tank Emptying**. Bilge, fuel, and ballast tanks are typically emptied prior to ship repair activities;
- **Fueling**. Fueling operations occur at BAE Systems;
- **Shipfitting**. Shipfitting is conducted at Southwest Marine, and is defined as the forming of ship plates and shapes, etc. according to plans, patterns, or molds;
- **Carpentry**. Woodworking, with associated wood dust production, is conducted at BAE Systems; and
- **Refurbishing/Modernization/Cleaning**. Refurbishing, modernization, and cleaning of ship processes are conducted at BAE Systems.

3.3.3 Materials Used by BAE Systems

Materials commonly used at BAE Systems are summarized below. Although a few specific materials are included, the list consists primarily of major categories.

- **Abrasive Grit**. Typically slag is collected from coal-fired boilers and consists principally of iron, aluminum, silicon, and calcium oxides. Trace elements such as copper, zinc, and titanium are also present. Sand, cast iron, or steel shot are also used as abrasives. Enormous amounts of abrasive are needed to remove paint; removing paint from a 15,000 square foot hull can take up to 6 days and consume 87 tons of grit. Grit is needed in all dry and wet abrasive blasting.
- **Paint**. Paints contain copper, zinc, chromium, and lead as well as hydrocarbons. Two major types of paints used on ship hulls are:
    - Anticorrosive paints (primers) vinyl, vinyl-lead, or epoxy-based coatings are used. Others contain zinc chromate and lead oxide.
    - Antifouling paints are used to prevent growth and attachment of marine organisms by continuously releasing toxic substances into the water. Cuprous oxide and tributyltin fluoride or tributyltin oxide are the principal toxicants in copper-based and organotin-based paints, respectively.
- **Miscellaneous Materials**. Oils (engine, cutting, and hydraulic), lubricants, grease, fuels, weld, detergents, cleaners, rust inhibitors, paint thinners, hydrocarbon and chlorinated solvents, degreasers, acids, caustics, resins, adhesives/cement/sealants, and chlorine.

3.3.4 Waste Generated by BAE Systems

Categories of wastes commonly generated by BAE Systems' industrial processes include, but are not limited to, those listed below.

- **Abrasive Blast Waste**. Spent Grit, Spent Paint, Marine Organisms, and Rust. Abrasive blast waste, consisting of spent grit, spent paint, marine organisms, and rust is generated in significant quantities during all dry or wet abrasive blasting procedures. The constituent of greatest concern with regard to toxicity is the spent paint, particularly the copper and tributyltin antifouling components, which are designed to be toxic and to continuously leach into the water. Other pollutants in paint included zinc, chromium, and lead. Abrasive blast waste can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters. Based on available data for the years 1987 through 1991, BAE Systems generates an average of 178 tons of abrasive blast waste per month.

- **Fresh Paint**. Losses occur when paint ends up somewhere other than its intended location (e.g., dry dock floor, bay, worker's clothing). These losses result from spills, drips, and overspray. Typical overspray losses are estimated at approximately 5 percent for air spraying, and 1 to 2 percent for airless spraying.
- **Bilge Waste/Other Oily Wastewater**. This waste is generated during tank emptying, leaks, and cleaning operations (bilge, ballast, fuel tanks). In addition to petroleum products (fuel, oil), tank washwater also contains detergents or cleaners and is generated in large quantities.
- **Blast Wastewater**. Hydroblasting generates large quantities of wastewater. In addition to suspended and settleable solids (spent abrasive, paint, rust, marine organisms) and water, blast wastewater also contains rust inhibitors such as diammonium phosphate and sodium nitrite.
- **Oils (engine, cutting, and hydraulic)**. In addition to spent products, fresh oils, lubricants, and fuels are released as a result of spills and leaks from ship or dry dock equipment, machinery, and tanks (especially during cleaning and refueling).
- **Waste Paints/Sludges/Solvents/Thinners**. These wastes are generated from cleaning paint equipment.
- **Construction/Repair Wastes and Trash**. These wastes include scrap metal, welding rods, slag (from arc welding), wood, rags, plastics, cans, paper, bottles, packaging materials, etc.
- **Miscellaneous Wastes**. These wastes include lubricants, grease, fuels, sewage (black and gray water from vessels or docks), boiler blowdown, condensate, discard, acid wastes, caustic wastes, and aqueous wastes (with and without metals).

3.3.5 Abrasive Blast Waste and Other Waste Discharges - Sampling Results

During numerous inspections, Regional Board inspectors observed abrasive blast waste and other wastes deposited in areas where it would probably be discharged into the waters of the state via stormwater runoff (see Section 3.7 BAE Systems Waste Discharges). Samples of abrasive blast waste and other wastes were collected in the vicinity of storm drains, or in other areas susceptible to being transported to San Diego Bay, during inspections on March 3, 1987, November 9, 1988, February 24 and 27, 1989, May 31, 1989, and August 14 and 15, 1989.

3.3.5.1 1987 Inspections and Sampling

During an inspection on March 3, 1987, the Regional Board inspector noted violations of the NPDES permit and reported "…this facility discharged water from the dry dock to the San Diego Bay." (RWQCB, 1987a). The inspector observed water carrying sand blasting grit and oil discharged to the bay. A follow-up inspection on March 18, 1987 noted the problem stilled existed and it appeared no corrective actions had been implemented (RWQCB, 1987b). Sample DTQ 867-407D was collected from undiluted discharge from the dry dock. The analytical results are shown in Table 3-1, below.

3.3.5.2 1988 Inspections and Sampling

During an inspection on November 9, 1988, the Regional Board inspector noted violations of the NPDES permit and reported "Sand blast waste and sewage are being discharged to San Diego Bay" (RWQCB, 1988a). Samples LKM 889-90137-035A and LKM 889-90137-035B were collected from sand blast waste that had accumulated on the barge and from San Diego Bay sediment where the waste entered the bay directly. The analytical results are shown in Table 3-1, below.

A subsequent inspection on November 15, 1988 noted that none of the violations cited in the previous inspection had been corrected (RWQCB, 1988b).

3.3.5.3 1989 Inspections and Sampling

The Regional Board conducted a series of inspections in February, May, and August 1989. Abrasive blast waste was noted during inspections on February 24 and 27, May 31, August 10, 15, and August 16 where it would probably be discharged into San Diego Bay via stormwater runoff, tidal action from the bay, or whenever the dry dock was submerged. The February 27, 1989 inspection noted potential problems as "The small floating dry dock has a wooden deck through which sand blast waste falls. This should be cleaned prior to sinking the dry dock." and "The large floating dry dock appears to have been sunk with sand blast waste in the port-aft stairwell." (RWQCB, 1989c).

During the inspections, samples were collected from various locations and analyzed for metals. On February 24, a sediment sample, DSJ-889-087, was collected from San Diego Bay and on February 27 another sample, LKM 889-112-5, was collected near the marine railway. Additional samples near the marine railways, LKM 889-200-E and F, were collected in May. During the August inspections, samples LKM 890-37-A through D was also collected from the Pride of San Diego and the small floating dry dock. In his summary report for the August inspections, the inspector reported that "The available evidence shows that both dry docks were sunk with sand blast waste on board in violation of Prohibition A.2." The analytical results are presented in Table 3-1, below (RWQCB, 1989d).

Table 3-1. Abrasive Blast Waste Sampling Results

Chemical	DTQ 867-407D[2,3]	LKM-90137-035A[2,3]	LKM-90137-035B[3]	DSJ 889-087[3]	LKM 889-112-5[3]	LKM 889-200-E[3]	Alternative Sediment Cleanup Levels	Background
Date	**3/18/87**	**11/9/88**	**11/9/88**	**2/24/89**	**2/27/89**	**5/31/89**		
Metals								
Arsenic (mg/kg)	0.54	<0.55	89	99.3	<23.4	133	**10**	7.5
Chromium (mg/kg)	7.5	<0.055	5.9	68.5	28.9	140	**81**	57
Copper (mg/kg)	85	<0.066	2,800[1]	323	6,690[1]	2,200	**200**	121
Lead (mg/kg)	1.8	<0.27	54	1,120	130	520	**90**	53
Mercury (mg/kg)	0.0067	0.003	<0.05	1.10	<0.50	0.231	**0.7**	0.57
Nickel (mg/kg)	1.5	<0.11	<0.38	18.4	18.1	25.6	**20**	15
Silver (mg/kg)	0.02	<0.044	<0.15	<2.28	5.20	4.18	**1.5**	1.1
Zinc (mg/kg)	2,000	<0.044	580	234	5,010[1]	5,556[1]	**300**	129

[1] The result exceeds criteria for characterization of hazardous waste per California Code of Regulations, Title 22, Chapter 11, Section 66261.24. The total threshold limit concentration (TTLC) for copper is 2500 mg/kg and the TTLC for zinc is 5000 mg/kg. The TTLC represents the total concentration of a constituent that may be present before a waste is classified as a hazardous waste.
[2] Chemistry units in mg/l.
[3] Sample collected in San Diego Bay near discharge location.
[4] Sample collected from Pride of San Diego or small floating dry dock.

Table 3-1. Abrasive Blast Waste Sampling Results, Continued

Chemical	LKM 889-200-F[3]	LKM 890-37A[4]	LKM 890-37B[4]	LKM 890-37C[4]	LKM 890-37D[4]	Alternative Sediment Cleanup Levels	Background
Date	**5/31/89**	**8/14/89**	**8/14/89**	**8/14/89**	**8/15/89**		
Metals							
Arsenic (mg/kg)	147	21.6	24.6	16.8	26.5	**10**	7.5
Chromium (mg/kg)	158	9.33	24.0	12.07	22.6	**81**	57
Copper (mg/kg)	3,464[1]	3,635[1]	2,500[1]	4,210[1]	5,538[1]	**200**	121
Lead (mg/kg)	856	534	53.6	214	61.0	**90**	53
Mercury (mg/kg)	0.145	<0.051	0.050	<0.062	<0.061	**0.7**	0.57
Nickel (mg/kg)	26.4	6.24	18.4	8.27	17.0	**20**	15
Silver (mg/kg)	5.59	2.54	2.39	2.33	4.59	**1.5**	1.1
Zinc (mg/kg)	6,567[1]	1,698	987	653	1,713	**300**	129

[1] The result exceeds criteria for characterization of hazardous waste per California Code of Regulations, Title 22, Chapter 11, section 66261.24. The total threshold limit concentration (TTLC) for copper is 2500 mg/kg and the TTLC for zinc is 5000 mg/kg. The TTLC represents the total concentration of a constituent that may be present before a waste is classified as a hazardous waste.
[2] Chemistry units in mg/l.
[3] Sample collected near discharge location.
[4] Sample collected from Pride of San Diego or small floating dry dock.

3.3.5.4 Discussion of Sampling Results

The inspections and analytical results indicate that abrasive blast wastes and other waste with elevated levels of metals have been discharged or deposited where they were, or probably will be, discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance. The analytical laboratory results for arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc exceed the background and alternative sediment cleanup levels presented in Sections 31 and 34 of this Technical Report at least once from the 11 samples collected. Copper and zinc samples exceed both the background and alternative sediment cleanup levels nine out of the eleven samples. The highest copper value is approximately 33 times the alternative sediment cleanup levels. Similarly the result for highest zinc value is 22 times the alternative cleanup.

Seven of the samples (LKM 90137-035B, LKM 889-112-5, LKM 889-200-F, LKM 890-37A, B, C, and D) exceed the criteria for total concentration of copper that may be present before the waste is classified as hazardous waste due to toxicity and three of the samples (LKM 889-112-5, LKM 889-200-E, and LKM 889-200-F) exceed the hazardous waste classification criteria for zinc (CCR Title 22). Furthermore, sample DSJ 889-087 exceed the hazardous waste classification criteria for lead (CCR Title 22). Under Title 22 the waste would be classified as hazardous and proper disposal would be in a Class I Landfill licensed to receive hazardous waste.

3.4 BAE Systems Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirements

BAE Systems has caused or permitted wastes from its shipyard operations to be discharged into San Diego Bay in violation of waste discharge requirements. The waste contains metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and probably polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs).

BAE Systems' waste discharges are regulated pursuant to Clean Water Act section 402 and Water Code section 13376. BAE Systems must comply with all conditions of the Shipyard NPDES Permit requirements. These requirements are referred to as either NPDES requirements or by the federal terminology "NPDES Permit". Any noncompliance of Shipyard NPDES Permit requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304. Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides, in relevant part, that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement…"

BAE Systems, San Diego Shipyard Facility Shipyard NPDES Permit requirement violations are documented in the Regional Board records via discharger monitoring and spill reports (filed by BAE Systems predecessor Southwest Marine), citizen complaints, Regional Board inspection reports, and Regional Board Notices of Violation issued to Southwest Marine, Inc. BAE Systems discharges of waste in violation of waste discharge requirements are presented below in Sections 3.7, 3.8, and 3.9 of this Technical Report.

3.5 BAE Systems Discharged Waste to San Diego Bay Creating a Condition of Pollution, Contamination, and Nuisance Conditions in San Diego Bay

BAE Systems has discharged waste, or deposited waste where it was discharged, into San Diego Bay and created, or threatens to create, a condition of pollution, contamination, and nuisance. Water Code section 13304 requires that a person who causes any waste to be discharged, or deposited where it probably will be discharged, into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance is subject to cleaning up or abating the effects of the waste.

Pollutants generated at the BAE Systems facility as a result of shipyard activities include metals, butyltins, PCBs, PCTs, PAHs, and petroleum hydrocarbons. Many of these same pollutants are present in the marine sediment adjacent to the BAE Systems facility in highly elevated concentrations as compared to sediment chemistry levels found at off-site reference stations located in areas of San Diego Bay.[36]

The Shipyard Report (Exponent, 2003) made the following findings about the chemical conditions at the Shipyard Sediment Site:

- The highest concentrations of most chemicals are found at the northern boundary of the BAE Systems site;
- The highest concentrations of PAH are found in proximity of the municipal storm drain outfall in the BAE Systems leasehold;
- Elevated concentrations of metals are also found near the municipal storm drain outfall in the BAE Systems leasehold;
- Elevated concentrations of PCBs are found near the northern boundary of BAE Systems, at the storm drain outfall on BAE Systems' leasehold, and at the foot of Sicard Street on the boundary of the two shipyards (BAE Systems and NASSCO);
- Petroleum hydrocarbons are distributed similarly to metals and PCBs, with an additional area of elevation near the southern boundary of NASSCO's leasehold; and

[36] See Section 15 of this Technical Report.

- Concentrations of all chemicals generally decrease with distance from shore.

BAE Systems has an extensive history of discharging substantial quantities of pollutants to San Diego Bay as a result of systemic problems and overall inadequacies in the implementation of its Best Management Practices Program to prevent such discharges. Some of BAE Systems' discharges are presented in Sections 3.7, 3.8, 3.9, and 3.10 of this Technical Report. As described in Sections 12 through 29 of this Technical Report, these same pollutants in the discharges have accumulated in San Diego Bay sediment adjacent to the BAE facility in concentrations that:

1. Adversely affect the beneficial uses of San Diego Bay as described in later sections of this Technical Report;
2. Violate a NPDES requirement prohibition pertaining to discharges that cause pollution, contamination, or nuisance37 conditions in San Diego Bay; and
3. Violate NPDES requirements pertaining to discharges that degrade marine communities, cause adverse effects on the environment or the public health, or result in harmful concentrations of pollutants in marine sediment.

The Porter-Cologne Water Quality Act defines "pollution" is defined as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects … the waters for beneficial uses …."[38] "Contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected."[39]

Accordingly it is concluded that BAE Systems has caused or permitted the discharge of waste to San Diego Bay in a manner causing the creation of pollution or nuisance conditions and that it is appropriate for the Regional Board to issue a cleanup and abatement order naming BAE Systems as a discharger pursuant to Water Code section 13304.

Further discussion on pollution, contamination, and nuisance are available in Sections 1.4 and 1.5 of this Technical Report.

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[37] BAE System's discharge of pollutants at the Shipyard Sediment Site has created or threatens to create a condition of nuisance in waters of the State. The discharges have caused or contributed to the accumulation of pollutants in the sediment in concentrations that are potentially injurious to the public health and affects a considerabl4e number of persons as provided in Water Code section 13050(m).
[38] Water Code section 13050(1).
[39] Water Code section 13050(k).

3.6 NPDES Requirement Regulation

Waste discharges from the BAE Systems facility have historically been regulated under Waste Discharge Requirements (WDRs) prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. These requirements are referred to as either NPDES requirements[40] or by the federal terminology "NPDES Permit". BAE Systems' first NPDES requirements started in 1979, when the Regional Board issued WDRs to regulate specific shipyard activities (hereafter referred to as Shipyard NPDES Permit). A listing of the NPDES requirements adopted by the Regional Board in effect at the time the facility was owned and operated by Southwest Marine, Inc and its successor, BAE Systems, is provided in Table 3-2 below.

Table 3-2. Southwest Marine/BAE Systems NPDES Permits

Order Number/ NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 79-74, NPDES No. CA0107697	Waste Discharge Requirements For Southwest Marine, Inc.	November 26, 1979	April 18, 1983
Order No. 83-11, NPDES No. CA0107697	Waste Discharge Requirements and Monitoring And Reporting Program For Southwest Marine, Inc. County Of San Diego	April 18, 1983	October 15, 1997
Order No. 97-36, NPDES No. CAG039001	Waste Discharge Requirements and Monitoring And Reporting Program For Discharges From Ship Construction, Modification, Repair, And Maintenance Facilities And Activities Located In The San Diego Region (TTWQ/CPLX 1A)	October 15, 1997	November 13, 2002
Order No. R9-2002-0161 NPDES No. CA0109151	Waste Discharge Requirements For Southwest Marine, Inc. San Diego County	November 13, 2002	Present

[40] Pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Act, to avoid the issuance by the United States Environmental Protection Agency of separate and duplicative NPDES permits for discharges in California that would be subject to the Clean Water Act, the State's Waste Discharge Requirements (WDRs) for such discharges implement the NPDES regulations and entail enforcement provisions that reflect the penalties imposed by the Clean Water Act for violation of NPDES permits issued by the U.S. EPA. Thus, the State's WDRs that implement federal NPDES regulations (NPDES requirements) serve in lieu of NPDES permits.

Pursuant to the NPDES requirements cited above, Southwest Marine, Inc. and its successor BAE Systems were required to develop and implement "Best Management Practices"[41] (BMPs) plans to limit discharges of pollutants into San Diego Bay. As described in the current NPDES requirements, R9-2002-0161, BMPs may be "structural" (e.g., tarpaulins and shrouds to enclose work areas, retention ponds, devices such as berms to channel water away from pollutant sources, and treatment facilities) or "non-structural" (e.g., good housekeeping, preventive maintenance, personnel training, inspections, and record-keeping). Beginning in 1997 numerical effluent limitations for oil and grease, settleable solids, turbidity, pH, and temperature were established in the NPDES requirements for certain discharges (e.g. Non-Contact Cooling Water; Miscellaneous Low Volume Water, and Fire Protection Water).

In 1992, BAE Systems obtained coverage under the State Water Resources Control Board's 1991 General Industrial NPDES Requirements for storm water discharges. These NPDES requirements supplemented BAE Systems NPDES requirements listed in Table in 3-2. The industrial storm water NPDES requirements applied specifically to discharges of pollutants through storm water, while the NPDES requirements listed in Table 3-2 applied to other discharges. A listing of the General Industrial NPDES Requirements for storm water discharges adopted by the State Water Resources Control Board in effect at the time the facility was owned and operated by Southwest Marine, Inc and its successor, BAE Systems, is provided in Table 3-3 below.

Table 3-3. Southwest Marine/BAE Systems NPDES Permits

Order Number/ NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 91-13-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	(Notice of Intent Filed) November 4, 1992	(Notice of Termination Approved) June 31, 1999
Order No. 97-03-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	(Notice of Intent Filed) June 31, 1999	(Notice of Termination Approved) July 29, 1999

[41] Best management practices ("BMPs") means schedules of activities, prohibitions of maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

The General Industrial NPDES Requirements for storm water discharges required BAE Systems to develop and implement plans to limit its discharges of pollutants from storm water runoff into San Diego Bay. Rather than relying on specific numerical effluent limitations, the NPDES requirements directed BAE Systems to create and follow "Best Management Practices" (BMPs). The General Industrial NPDES Requirements for storm water discharges also required BAE Systems to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) and a Storm Water Pollution Monitoring Plan (SWPMP). The requirements specified that the SWPPP be required to include, among other things, the following:

- Descriptions of sources that might add significant quantities of pollutants to storm water discharges;
- A detailed site map;
- Descriptions of materials that had been treated, stored, spilled, disposed of, or leaked into storm water discharges since November 1988;
- Descriptions of the management practices that were employed to minimize contact between storm water and pollutants from vehicles, equipment, and materials;
- Descriptions of existing structural and non-structural measures to reduce pollutants in storm water discharges;
- Descriptions of methods of on-site storage and disposal of significant materials;
- Descriptions of outdoor storage, manufacturing, and processing activities;
- A list of pollutants likely to be present in significant quantities in storm water discharges and an estimate of the annual amounts of those pollutants in storm water discharge;
- Records of significant leaks or spills of toxic or hazardous pollutants to storm water;
- Summary of existing data describing pollutants in storm water discharge;
- Descriptions of storm water management controls, including good housekeeping procedures, preventive maintenance, and measures to control and treat polluted storm water; and
- A list of the specific individuals responsible for developing and implementing the SWPPP.

3.6.1 Order No. 79-74, Shipyard NPDES Permit No. CA0107697

Order No. 79-74, Shipyard NPDES Permit No. CA0107697 was in effect from November 26, 1979 to April 18, 1983, and contained the following requirement that relates to the discussions contained herein:

- B. PROVISIONS … 3. The discharger shall comply with Monitoring and Reporting Program No. 79-74 as contained in this Order or as modified by the Executive Officer. Within 30 days of the adoption of this Order, the discharger shall submit, in writing, the name of the person authorized to sign the monitoring reports in accordance with the attached "General Monitoring and Reporting Provisions." In accord with the provisions of section 13267(b) of the Water Code, the monitoring reports shall be submitted under penalty of perjury.

3.6.2 Order No. 83-11, Shipyard NPDES Permit No. CA0107697

Order No. 83-11, Shipyard NPDES Permit No. CA0107697 was in effect from April 18, 1983 to October 15, 1997, and contained the following requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The deposition or discharge of refuse, rubbish, materials of petroleum origin, spent abrasives (including old primer and antifouling paint), paint, paint chips, or marine fouling organisms into San Diego Bay or at any place where they would be eventually transported to San Diego Bay is prohibited;
- B. DISCHARGE SPECIFICATIONS … 2. Effluent discharged to San Diego Bay must be essentially free of: (a) Material that is floatable or will become floatable upon discharge. (b) Settleable material or substances that form sediments which degrade benthic communities or other aquatic life. (c) Substances toxic to marine life due to increases in concentrations in marine waters or sediments;
- B. DISCHARGE SPECIFICATIONS … 3. The discharger shall comply with the Water Pollution Control Plan described in Finding No. 9. Any proposed amendment to the Water Pollution Control Plan must be approved in writing by the Executive Officer.

  Finding 9 states the following: The Water Pollution Control Plan by Southwest Marine, Inc., identifies the following measures to be taken for the control of pollutants: A. Demolition Activities (1) Quay wall (a) Structures will be removed from the land and debris removed to an approved disposal site as it accumulates. (b) Excavation behind the existing quay wall will be done before the sheet piles are pulled. The sheet piles will act as a curtain to prevent debris resulting from demolition activities from entering the bay. (c) Excavation material not to be replaced and compacted will be removed from the site. Thus, excavation material will not be available to be carried into the bay by any rain runoff. (2) Buildings (a) Buildings will be emptied of all furnishings prior to demolition. (b) Building debris and concrete foundations will be removed from the yard as demolition proceeds. (3) Piers (a) Piers will be cleared of debris and broom-cleaned prior to deck demolition. (b) Pier decks will be removed by Southwest Marine, Inc. No deck material will be dumped into the bay. (c) Piles will be pulled and disposed of on land. B. Construction Activities (1) Pier Replacement (a) Piles will be precast off the yard with no surplus concrete allowed within the construction area. (b) Care will be taken while casting pile caps and cast-in-place sections of the deck to prevent spillage into the bay. (c) Extensive use of precast deck will be made to minimize the pouring of concrete over the water. (d) Deck fittings and utility anchorages will use either bolt-through-connections or cast-in-place anchors. No coring or drilling for anchors will be done. This will eliminate concrete chips and dust. (2) Quay wall (a) Sheet piling will be driven prior to any backfilling to prevent fill materials from entering the bay. (b) Care will be taken while pouring the quay wall pile cap to prevent concrete spillage into bay. (c) After compaction and grading, exposed areas will be protected with Asphaltic Concrete paving to prevent soil from entering the bay. (3) Shore Improvements (a) Excavation for foundations will be minimized. Excavation material will be removed by the Contractor as work progresses in order to prevent their materials from entering the bay. (b) Slopes will be protected from runoff by Asphaltic Concrete paving. (4) Miscellaneous (a) All parking lots will, as part of their improvement, be paved. (b) Concrete spillage will be removed by the contractor. Concrete delivered in excess of that required for a given pour will not be disposed of on the yard. C. Marine Railways (1) Sump areas and waste dams will be cleaned out manually. Cleaning will be done as necessary when a ship is being worked on. (2) Work areas adjacent to the railways will be swept broom-clean as necessary when a ship is being worked on. (3) Material removed from sump areas, and dams will be removed by truck by a contract waste removal service or by Southwest Marine, Inc. D. Dry docks (1) Sandblast curtains will be rigged prior to conducting sandblasting. (2) After work is complete and prior to dry dock flooding, the dry dock floor will be swept broom-clean. (3) The waste (usually sandblast grit, trash, scale, rust, paint chips, and removed marine organisms) will be transferred to trucks and removed by a contract waste removal service or Southwest Marine, Inc. and disposed of at a dumpsite approved by the Regional Board Executive Officer. E. Piers (1) Separate containers for trash, garbage, and metal scrap are located on all piers. (2) Piers will be swept broom-clean, as necessary. F. Transfer Platforms (1) Shore platforms, transfer carriages, and work areas adjacent to the platforms will be swept broom-clean as necessary when a ship is being worked on. (2) Sandblast curtains will be rigged prior to conducting sandblasting. (3) Waste (usually sandblast grit, trash, scale, rust, paint chips, and removed marine organisms) will be transferred to trucks and removed by a contract waste removal service or Southwest Marine, Inc. and disposed of at a dumpsite approved by the Regional Board Executive Officer. G. Open Work Areas (1) Open work areas will be swept broom-clean as necessary. (2) Containers for waste are located at all open work areas. H. Accidental Spills Accidental spills could result in the release of oil, fuel, coolants, paint, and sandblast material. Emergency response procedures for liquid spills on land or on water are contracted with Cleaning

Dynamics Corporation (approximately three blocks from Southwest Marine, Inc.). Minor liquid spills on land and sandblast material spills would be cleaned by Southwest Marine, Inc.;

- C. RECEIVING WATER LIMITATIONS. The Southwest Marine, Inc. discharge shall not cause violation of the following water quality objectives in San Diego Bay: "…5. Toxicity (a) All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. …"; and
- Prohibitions in the Basin Plan were also applicable to Order No. 83-11, NPDES Permit No. CA0107697 and were summarized in Finding 15 as follows: The Basin Plan established the following prohibitions which are applicable to the discharge:

  "The dumping or deposition from shore or from vessels of oil, garbage, trash or other solid municipal, industrial or agricultural waste directly into waters subject to tidal action or adjacent to waters subject to tidal action in any manner which may permit it to be washed into the waters subject to tidal action is prohibited.

  "The discharge of municipal and industrial waste sludge and sludge digester supernatant directly to the ocean or into a waste stream that discharges to the ocean without further treatment, is prohibited.

  "The discharge of sewage from shore or vessels into the waters of San Diego Bay, Mission Bay, or small boat harbors is prohibited.

  "Discharge of industrial wastewaters exclusive of cooling water, clear brine or other waters which are essentially chemically unchanged, into waters subject to tidal action is prohibited.

  "The dumping or deposition of chemical wastes, chemical agents or explosives into waters subject to tidal action is prohibited."

3.6.3 Order No. 97-36, Shipyard NPDES Permit No. CAG039001

Order No. 97-36, Shipyard NPDES Permit No. CAG039001, was in effect from October 15, 1997 to November 13, 2002 and contained the following requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The discharge of sewage (except as noted in the Basin Plan Waste Discharge Prohibitions) to San Diego Bay is prohibited;

- A. PROHIBITIONS … 5. The discharge of rubbish, refuse, debris, materials of petroleum origin (other than ship launch grease / wax) waste zinc plates, abrasives, primer, paint, paint chips, solvents, and marine fouling organisms, and the deposition of such wastes at any place where they could eventually be discharged is prohibited. This pollution does not apply to the discharge of marine fouling organisms removed from unpainted, uncoated surfaces by underwater operations (see Prohibition 11). (Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals or dead fish deposited or caused to be deposited by man.);
- A. PROHIBITIONS … 8. Discharges of wastes and pollutants identified in Finding 2.a.i through 2.a.ix of this Order are prohibited. Discharges of wastes and pollutants not specifically identified in Finding 2.b through 2.e of this Order are prohibited.

  Finding 2 states the following: "FINDING 2. a. Ship construction, modification, repair, and maintenance activities result or have the potential to result in discharges to San Diego Bay of wastes and pollutants which are likely to cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; cause or contribute to violation of an applicable water quality objective; and/or otherwise adversely affect the quality and/or beneficial uses of waters of the state and waters of the United States. Such discharges include: i. water contaminated with abrasive blast materials, paint, oils, fuels, lubricants, solvents, or petroleum; ii. hydroblast water; iii. tank cleaning water from tank cleaning to remove sludge and/or dirt; iv. clarified water from oil/water separation; v. steam cleaning water; vi. demineralizer / reverse osmosis brine; vii. floating dry dock sump water when the dry dock is in use as a work area or when the dry dock is not in use as a work area but before the sump has been purged following such use; viii. oily bilge water; ix. contaminated ballast water; and x. the first flush of storm water runoff from high risk areas. b. Ship construction, modification, repair, and maintenance activities also result or have the potential to result in discharges to San Diego Bay of wastes and pollutants which pose less threat than those identified in Finding 2.a above. Such discharge included: i. vessel washdown water; ii. floating dry dock submergence/emergence water; iii. graving dock flood water; iv. graving dock sump pump test water; v. shipbuilding ways flood water; vi. floating dry dock sump water when the dry dock is not in use as a work area after the sump has been purged following such use; vii. pipe and tank hydrostatic test water; viii. graving dock gate and wall leakage water; ix. shipbuilding ways gate and wall leakage and hydrostatic relief water; x. miscellaneous low-volume water; and xi. storm water runoff other than the first flush of storm water runoff from high risk areas.";

- B. DISCHARGE SPECIFICATIONS … 5. Waste discharged shall be essentially free of: "…b. Settleable material or substances that may form sediments which will degrade benthic communities or other aquatic life. c. Substances which will accumulate to toxic levels in marine waters, sediments, or biota. …"; and
- C. RECEIVING WATER LIMITATIONS. Discharges shall not cause or contribute to violation of the following receiving water limitations: 1. There shall be no adverse impact on human health or the environment. 2. There shall be no impairment of any beneficial use or violations of the applicable Basin Plan Water Quality Objectives (Attachment C) or any applicable State water quality control plan or policy. 3. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded. 4. Natural light shall not be significantly reduced as the result of the discharge of waste. 5. The rate of deposition of inert solids and the characteristics of inert solids in sediments shall not be changed such that benthic communities are degraded. 6. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions. 7. The concentration of substances in marine sediments shall not be increased to levels that would degrade indigenous biota. 8. The concentration of organic materials in sediment shall not be increased to levels that would degrade marine life. 9. Substances shall not be present in the water column, sediments, or biota at concentrations that adversely affect beneficial uses or which will bioaccumulate to levels that are harmful to aquatic organisms, wildlife, or human health. 10. The daily maximum chronic toxicity of waters of the United States shall not exceed 1 Toxic Unit Chronic (TUc), as determined using a standard test species and protocol approved by the Executive Officer.

3.6.4 Order No. R9-2002-0161, Shipyard NPDES Permit No. CA0109151

Order No. R9-2002-0161, Shipyard NPDES Permit No. CA0109151, in effect from November 13, 2002 to present, contains the following requirements that relate to the discussions contained herein:

- A. PROHIBITIONS … 6. The discharge of rubbish, refuse, debris, materials of petroleum origin, waste zinc plates, abrasives, primer, paint, paint chips, solvents, and marine fouling organisms, and the deposition of such wastes at any place where they could eventually be discharged is prohibited. This prohibition does not apply to the discharge of marine fouling organisms removed from unpainted, uncoated surfaces by underwater operations and discharges that result from cleaning of floating booms that were installed for 'Force Protection' purposes (see Prohibition 10). (Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals deposited or caused to be deposited by man.);

- A. PROHIBITIONS … 8. The discharge or bypassing of untreated waste to San Diego Bay is prohibited. (This prohibition does not apply to non-contact cooling water, miscellaneous low volume water, and fire protection water streams which comply with the requirements of this Order for elevated temperature waste discharges and which do not contain pollutants or waste other than heat.) ; and
- B. DISCHARGE SPECIFICATIONS … 4. The following acute toxicity effluent limit applies to Undiluted storm water discharges to San Diego Bay, that are associated with industrial activity: Acute toxicity: In a 96-hour static or continuous flow bioassay test, the discharge shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time, using a standard test species and protocol approved by the Regional Board.
- B. DISCHARGE SPECIFICATIONS … 9. Waste discharges shall be essentially free of: b. Settleable material or substances that may form sediments which will degrade benthic communities or other aquatic life. c. Substances which will accumulate to toxic levels in marine waters, sediments, or biota; and
- C. RECEIVING WATER LIMITATIONS. Discharges shall not cause or contribute to violation of the following receiving water limitations: 1. There shall be no adverse impact on human health or the environment. 2. There shall be no impairment of any beneficial use or violations of the applicable Basin Plan Water Quality Objectives (Attachment C) or any applicable State water quality control plan or policy. 3. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded. 4. Natural light shall not be significantly reduced as the result of the discharge of waste. 5. The rate of deposition of inert solids and the characteristics of inert solids in sediments shall not be changed such that benthic communities are degraded. 6. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions. 7. The concentration of substances in marine sediments shall not be increased to levels that would degrade indigenous biota. 8. The concentration of organic materials in sediment shall not be increased to levels that would degrade marine life. 9. Substances shall not be present in the water column, sediments, or biota at concentrations that adversely affect beneficial uses or which will bioaccumulate to levels that are harmful to aquatic organisms, wildlife, or human health.

3.6.5 Order No. 91-13-DWQ, NPDES Permit No. CAS000001, General Industrial NPDES Requirements for Storm Water Discharges

Order No. 91-13-DWQ, NPDES Permit No. CAS000001, in effect from November 4, 1992 to February 5, 1998 contained the following key narrative limitations that relate to the discussions contained herein:

- A. DISCHARGE PROHIBITIONS: … 3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance; and
- B. RECEIVING WATER LIMITATIONS. … 1. Storm water discharges to any surface or ground water shall not adversely impact human health or the environment.

3.7 BAE Systems' Waste Discharges

BAE Systems has (1) caused or permitted waste from its shipyard operations to be discharged to San Diego Bay in violation of waste discharge requirements; and (2) discharged or deposited waste where it was discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance.

BAE Systems, San Diego Shipyard Facility discharges and Shipyard NPDES Permit requirement violations are documented in the Regional Board records via discharger monitoring and spill reports (filed by BAE Systems predecessor Southwest Marine), citizen complaints, Regional Board inspection reports, and Regional Board Notices of Violation issued to Southwest Marine, Inc. These discharges are itemized in Tables 3-4 through 3-7, below.

Table 3-4. BAE Systems' Discharges from 1979 to 1983

Date	Description	Technical Report Reference[1]	Source	Citation[2]
April 16, 1981	Dumping spent abrasive grit waste to a landfill without prior approval of Regional Board Executive Officer.	Section 3.4 and 3.5	Notice of Violation	Order No. 79-74, B. Provisions 3

[1] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.
[2] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

Table 3-5. BAE Systems' Discharges from 1983 to 1997

Date	Description	Technical Report Reference[1]	Source	Citation[2]
February 25, 1986	Discharge of turbid runoff water to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
October 30, 1986	Discharge of cooling water carrying sand and other floatables to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
May 5, 1987	Elevated levels of zinc, copper and chromium in blast grit discharge sampled during 3/18/1987 RWQCB inspections.	Sections 3.4 and 3.5	Notice of Violation	Order No. 83-11, A. Prohibitions 2 and B. Discharge Specifications 2
March 2, 1988	Discharge of abrasive blast waste to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
October 26, 1988	Discharge of steam cleaning waste to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
November 9, 1988	Discharge of abrasive blast waste and sewage to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
November 15, 1988	Discharge of abrasive blast waste and sewage to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
November 23, 1988	Discharge of sewage to San Diego Bay.	Sections 3.4 and 3.5	Spill Report	Order No. 83-11, A. Prohibitions 2
February 27, 1989	Sample collected near marine railway contained hazardous levels of copper (6,690 mg/kg) and zinc (5,010 mg/kg) found in area where it could be washed in to San Diego Bay due to storm runoff.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
May 31, 1989	Discharge of abrasive blast waste from Marine Railway to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
August 14, 1989	Discharge of abrasive blast waste from large floating dry dock to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
August 15, 1989	Discharge of abrasive blast waste from small floating dry dock to San Diego Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
August 16, 1989	Discharge of abrasive blast waste from small floating dry dock to San Diego Bay. Sample contained 3,635 mg/kg copper.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
August 17, 1989	Discharge of 10 to 20 gallons of diesel to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
October 12, 1989	Discharge approximately 1 gallon of paint overspray to San Diego Bay.	Sections 3.4 and 3.5	Spill Report/ Complaint	Order No. 83-11, A. Prohibitions 2
November 15, 1989	Discharge of sewage overflow to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
December 8, 1989	Discharge 5 gallons of paint to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
December 8, 1989	Discharge 5 gallons of solvent to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
December 8, 1989	50 gallons of oil spilled. Unknown quantity discharged into the storm drain and to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
December 12, 1990	Discharge of small amount of oil to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
January 7, 1991	Discharge of abrasive blast and paint waste to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
January 8, 1991	Discharge of 15 gallons of bilge waste oil to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
February 1, 1991	Discharge of 1 gallon of a mixture of oily and soapy liquid to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
June 18, 1992	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
June 18, 1992	Deposit of sand and grit waste where it will probably be discharged to Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
June 18, 1992	Anchor chain blasting barge without containment BMPs.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
June 18, 1992	Deposit of abrasive blast waste on marine railway where it will probably be discharged to Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
October 20, 1992	Discharge of abrasive blast waste to San Diego Bay.	Sections 3.4 and 3.5	Anonymous Spill Report	Order No. 83-11, A. Prohibitions 2
February 19, 1993	Discharge of 5 gallons of oil waste to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2

Date	Description	Technical Report Reference[1]	Source	Citation[2]
March 18, 1993	Discharge of unknown quantity of oil to San Diego Bay	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
March 19, 1993	Discharge of 1 gallon of oil to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
September 15, 1993	Discharge of 30 to 50 gallons of lube oil to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
September 20, 1993	Discharge of 5 gallons of diesel fuel to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
November 17, 1993	Large hole on the anchor chain barge allowing blast grit to spread to open end of barge.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
October 13, 1994	Deposit of abrasive blast waste where it will probably be discharged to Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, A. Prohibitions 2
June 16, 1995	Deposit of debris and other substances in storm drains where it will probably be discharged to Bay.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
June 16, 1995	Sump needs cleaning of observed contaminated soil. Rain occurred the night before and discharge valve is open.	Sections 3.4 and 3.5	RWQCB Inspection	Order No. 83-11, B. Discharge Specifications 3/Finding 9
September 29, 1996	Discharge of 3 gallons of oil to San Diego Bay.	Sections 3.4 and 3.5	USCG Spill Report	Order No. 83-11, A. Prohibitions 2
February 18, 1997	Discharge of less than ½ gallon of CHT - sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 83-11, Basin Plan Prohibitions / Finding 15

Date	Description	Technical Report Reference[1]	Source	Citation[2]
May 1, 1997	Discharge of abrasive blast waste to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 83-11, A. Prohibitions 2

[1] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[2] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

Table 3-6. BAE Systems' Discharges from 1997 to 2002

Date	Description	Technical Report Reference[1]	Source	Citation[2]
March 17, 1998	Discharge of 20 ounces of Betadine solution to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
March 18, 1998	Discharge of unknown quantity of fuel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
March 20, 1998	Discharge of less than 1 gallon of paint overspray to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
May 8, 1998	Discharge of 20 gallons of CHT - sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
May 9, 1998	Discharge 60 gallons of hydroblast/ballast water to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
July 23, 1998	Discharge of 0.025 gallons of paint spray from ruptured hose to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
October 8, 1998	Discharge of 10 gallons of diesel/water mix to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
October 9, 1998	Discharge of ¼ gallon of diesel/water mix to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
November 25, 1998	Discharge of unknown quantity of dust film to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
December 8, 1998	Discharge of a 50' x 5' film of dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
December 13, 1998	Discharge of a 75' x 25' film of abrasive blast waste dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8

Date	Description	Technical Report Reference[1]	Source	Citation[2]
January 22, 1999	Discharge of approximately 15 gallons of basin wash down wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
March 10, 1999	Discharge of approximately 4,320 gallons of sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
March 11, 1999	Discharge of approximately 1 gallon of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
March 26, 1999	Discharge of unknown quantity of sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
March 26, 1999	Discharge of a 50’ x 50’ film of dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
March 30, 1999	Discharge of a 5’ x 5’ film of paint overspray to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
April 7, 1999	Discharge of a 2’ x 3’ film of paint overspray to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 8, 1999	Discharge of approximately 35 gallons of dry dock wash wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
April 12, 1999	Discharge of a 10’ x 30’ film of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 13, 1999	Discharge of less than 100 gallons of pressure wash waster to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
April 14, 1999	Discharge of ½ gallon of liquid degreaser to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
April 14, 1999	Discharge of a 10' x 20' film of paint overspray to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 22, 1999	Discharge of unknown quantity of petroleum product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 28, 1999	Discharge of 2.5 gallons oily water to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
May 2, 1999	Discharge of less than 5 gallons diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
May 7, 1999	Discharge of 1 gallon of petroleum product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
May 13, 1999	Discharge of unknown quantity of a yellow petroleum substance to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
May 16, 1999	Discharge of an unknown quantity of dust and fine debris to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
May 28, 1999	Discharge of less than 0.25 gallons of hydraulic oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
March 30, 1999	Discharge of 5' x 5' film of paint to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
June 1, 1999	Discharge of 1 gallon of pressure wash wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
August 5, 1999	Discharge of 5 gallons of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5

Date	Description	Technical Report Reference[1]	Source	Citation[2]
October 5, 1999	Discharge of 1 gallon of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
October 8, 1999	Discharge of less than 10 gallons of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
February 20, 2000	Discharge of less than 5 gallons of CHT – sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
April 6, 2000	Discharge of 200 gallons of CHT – sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
April 28, 2000	Discharge of 200 gallons of CHT – sewage to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
May 1, 2000	Discharge of ½ gallon of water-based paint to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
September 22, 2000	Discharge of 50 gallons of JP-5 to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
October 29, 2000	Discharge of ½ ounce of diesel fuel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
November 2, 2000	Discharge of a 5’x 8’ sheen of paint chips to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
November 20, 2000	Discharge of 5 gallons of abrasive blast waste to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
December 5, 2000	Discharge of less than one gallon of abrasive blast waste to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8

Date	Description	Technical Report Reference[1]	Source	Citation[2]
December 11, 2000	Discharge of a 20’ x 20’ film of paint to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
December 12, 2000	Discharge of < 5 gallons abrasive blast waste to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
January 29, 2001	Discharge of ½ gallon of hydraulic fluid to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 2, 2001	Discharge of 3 to 5 gallons of unknown fuel product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 26, 2001	Discharge of about 1 ounce of water, waste paint, and thinner to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
October 15, 2001	Discharge of 1,275 gallons of CHT – non-contact cooling water to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 2
October 16, 2001	Discharge of a 15’ x 10’ film of abrasive dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8
October 20, 2001	Discharge of less than 1 gallon of oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
November 2, 2001	Discharge 1 gallon of JP-5 to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
April 9, 2002	Discharge of 2 pints of engine oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 5
September 25, 2002	Discharge of less than 5 gallons of unknown liquid to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8

Date	Description	Technical Report Reference[1]	Source	Citation[2]
November 12, 2002	Discharge of less than 5 gallons of abrasive blast waste dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. 97-36, A. Prohibitions 8

[1] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[2] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

Table 3-7. BAE Systems' Discharges from 2002 to 2005

Date	Description	Technical Report Reference[1]	Source	Citation[2]
November 25, 2002	Discharge of approximately 5 gallons of AFFF (aqueous film forming foam) to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
January 6, 2003	Discharge less than 1 gallon of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
January 23, 2003	Discharge of 750 gallons of AFFF to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
January 24, 2003	Discharge of less than 1 gallon of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
March 4, 2003	Discharge of less than 1 gallon of diesel to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
March 13, 2003	Discharge of less than 1 gallon of oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6

Date	Description	Technical Report Reference[1]	Source	Citation[2]
September 23, 2003	Discharge of 1 gallon of petroleum to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
October 1, 2003	Discharge of 1 cup of hydraulic oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
October 3, 2003	Discharge of less than 1 gallon of hydraulic oil to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
October 9, 2003	Discharge of 10 gallons of mopping wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
October 17, 2003	Discharge of unknown quantity of oily product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
October 29, 2003	Discharge of unknown quantity of oily product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
November 4, 2003	Discharge of less than 1 gallon of water and grit to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
December 2, 2003	Discharge of more than 1000 gallons of dry dock wash down wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
December 16, 2003	Discharge of unknown quantity of ash to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
January 14, 2004	Discharge of unknown quantity of oil and particulates to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
January 19, 2004	Discharge of 10 gallons of soapy water to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8

Date	Description	Technical Report Reference[1]	Source	Citation[2]
February 5, 2004	Discharge of a trickle of hydroblast wastewater to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
February 19, 2004	Discharge of 5 gallons of liquid from “flammable” marked bucket to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
February 25, 2004	Discharge of 100 gallons of rust colored water to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
March 19, 2004	Discharge of unknown quantity of dust to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
March 19, 2004	Discharge of less than 1quart of DFM to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 8
May 12, 2004	Discharge of 10’ x 30’ overspray of paint to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
May 21, 2004	Discharge of 2 lbs. of abrasive blast waste to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
September 9, 2004	Discharges of 10 gallons of soapy water and trickle of hydroblast water spilled to Bay on January 19, 2004 and February 5, 2004 (respectively).	Sections 3.4 and 3.5	Notice of Violation	Order No. R9-2002-0161, A. Prohibitions 8
September 9, 2004	Discharges of 10’ x 30 area of paint overspray and approximately two lbs of abrasive blast waste dust spilled to Bay on May 12, 2004 and May 21, 2004 (respectively).	Sections 3.4 and 3.5	Notice of Violation	Order No. R9-2002-0161, A. Prohibitions 6

Date	Description	Technical Report Reference[1]	Source	Citation[2]
December 7, 2004	Discharge of less than 1 ounce of petroleum product to Bay.	Sections 3.4 and 3.5	BAE Spill Report	Order No. R9-2002-0161, A. Prohibitions 6
March 21, 2005	Discharge of 2,487 gallons of storm water spilled to Bay with 85% toxicity survival not meeting 90% toxicity survival on February 26, 2004.	Sections 3.4 and 3.5	Notice of Violation	Order No. R9-2002-0161, B. Discharge Specifications 4

[1] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.
[2] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

3.8 Storm Water Monitoring for Shipyard NPDES Requirements

Since 1983, BAE Systems' NPDES Permits have included Discharge Specifications and Receiving Water Limitations that have set a narrative limit on discharge pollutant concentrations with intent to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

While operating under various Shipyard NPDES Permits, BAE Systems has discharged constituents at levels that are elevated compared to levels established by the California Toxics Rule (CTR) for saltwater.[42] The U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included as numerical effluent limitations in any of the NPDES Permits issued to BAE Systems. However, the numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in a water body is detrimental to its beneficial uses. By comparing CTR values with pollutant levels in historical discharges, the Regional Board is able to determine which discharges may have contributed to toxic chemical concentrations in marine water, marine life and sediment at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an elevated probability that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges did cause toxic chemical concentrations in marine water, marine life, and

[42] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

sediment, and/or did contribute to the present condition of pollution at the Shipyard Sediment Site, there exists an NPDES violation.

While BAE Systems' various Shipyard NPDES Requirements[43] did not provide specific numerical limitations for all possible chemicals, the Regional Board did require that discharges from NASSCO not cause a violation of the key requirements, described in Section 3.6, above. Monitoring reports submitted by BAE Systems during the years 1987 through 1989, 2000, and 2002 through 2004 indicate that elevated levels of arsenic, cadmium, chromium, copper, lead, nickel, and zinc were present in storm water discharged from the BAE Systems site to San Diego Bay. Specific discharges are presented in Tables 3-8 through 3-10 below.

[43] Order No. 83-11, Shipyard NPDES No. CAO107697, Order No. 97-36, Shipyard NPDES Permit No. CAG039001, and Order No. R9-2002-0161, Shipyard NPDES Permit No. CA0109151

Table 3-8. Discharge Samples above CTR Values Occurring from 1983 to 1997

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 18, 1987	Arsenic	0.54 mg/L	0.036 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)
March 18, 1987	Cadmium	0.05 mg/L	0.0093 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)
March 18, 1987	Chromium	7.5 mg/L	0.05 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)
March 18, 1987	Copper	85 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 18, 1987	Lead	1.8 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)
March 18, 1987	Nickel	1.5 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)
March 18, 1987	Zinc	2000 mg/L	0.081 mg/L	Section 3.4 and 3.5	Dry dock Sample	Regional Board Sample Report	Order No. 83-11, B. Discharge Specifications 2 and C. Receiving Water Limitations 5(a)

[1] 40 CFR 131.38

[2] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[3] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

Table 3-9. Discharge Samples above CTR Values Occurring from 1997 to 2002

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 12, 2000	Copper	0.553 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 1	Southwest Marine (SWM) Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
February 12, 2000	Copper	0.0955 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 3	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
February 12, 2000	Lead	0.0384 mg/L	0.0081 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
February 12, 2000	Nickel	0.0189 mg/L	0.0082 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 12, 2000	Zinc	0.541 mg/L	0.081 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 1	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
February 12, 2000	Zinc	0.0871 mg/L	0.081 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 3	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
March 5, 2000	Copper	0.238 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 3	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
March 5, 2000	Lead	0.015 mg/L	0.0081 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 1	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10

Date	**Constituent**	**Concentration**	**CTR Saltwater Criteria (Continuous Concentration)**[1]	**Technical Report Reference**[2]	**Discharge Source**	**Source**	**Citation**[3]
March 5, 2000	Zinc	0.333 mg/L	0.081 mg/L	Sections 3.4 and 3.5	Storm Water Discharge Pier 3	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
March 26, 2002	Copper	0.014 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Non-Contact Cooling Water	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10
March 26, 2002	Copper	0.017 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Fire Protection Water	SWM Monitoring Report	Order No. 97-36, B. Discharge Specifications 5b and 5c, and C. Receiving Water Limitations 1 through 10

[1] 40 CFR 131.38

[2] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[3] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

Table 3-10. Discharge Samples above CTR Values Occurring from 2002 to 2004

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 27, 2002	Copper	0.0163 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 27, 2002	Copper	0.00934 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
December 10, 2002	Copper	0.0153 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 1 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
December 10, 2002	Copper	0.00772 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 8, 2003	Copper	0.0159 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 10, 2003	Copper	0.0197 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 27, 2003	Copper	0.0104 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 27, 2003	Copper	0.0105 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 27, 2003	Copper	0.00947 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 27, 2003	Copper	0.00917 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2003	Copper	0.00835 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2003	Copper	0.00837 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 17, 2003	Copper	0.0066 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
March 17, 2003	Copper	0.00665 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 9, 2003	Copper	0.00954 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 9, 2003	Copper	0.00948 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 9, 2003	Copper	0.00673 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 9, 2003	Copper	0.00702 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 12, 2003	Copper	0.00853 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 12, 2003	Copper	0.00759 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
May 12, 2003	Copper	0.00702 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 21, 2003	Copper	0.0097 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 21, 2003	Copper	0.00997 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 21, 2003	Copper	0.0252 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
July 21, 2003	Copper	0.0254 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 21, 2003	Copper	0.00849 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
July 21, 2003	Copper	0.00849 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 15, 2003	Copper	0.0113 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 1 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
August 15, 2003	Copper	0.0111 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 1 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 15, 2003	Copper	0.007 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
August 15, 2003	Copper	0.00593 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
October 17, 2003	Copper	0.00772 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 17, 2003	Copper	0.00985 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 19, 2003	Copper	0.00632 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
November 19, 2003	Copper	0.00737 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 14, 2004	Copper	0.00922 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 14, 2004	Copper	0.00589 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 14, 2004	Copper	0.0126 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
January 14, 2004	Copper	0.00844 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Storm Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
February 18, 2004	Copper	0.00781 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 2004	Copper	0.00491 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 22, 2004	Copper	0.00847 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Cooling Water	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
April 22, 2004	Copper	0.00863 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 14, 2004	Copper	0.00591 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 1 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
May 14, 2004	Copper	0.0243 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Pier 3 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9
May 14, 2004	Copper	0.0318 mg/L	0.0031 mg/L	Sections 3.4 and 3.5	Building 13 Fire Pump	SWM Monitoring Report	Order No. R9-2002-0161, B. Discharge Specifications 9b and 9c, and C. Receiving Water Limitations 1 through 9

[1] 40 CFR 131.38

[2] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[3] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

3.9 Storm Water Monitoring for General Industrial NPDES Requirements for Storm Water Discharges

Since 1992, BAE Systems' General Industrial NPDES Requirements for Storm Water Discharges have included Discharge Prohibitions and Receiving Water Limitations that have set a narrative limit on discharge pollutant concentrations with intent to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

While subject to regulation under the General Industrial NPDES Requirements for Storm Water Discharges, BAE Systems discharged pollutants at levels that are elevated compared to levels established by the California Toxics Rule (CTR) for saltwater.[44] The U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included as numerical effluent limitations in any of the Industrial NPDES Requirements issued to BAE Systems. However, the numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in a water body is detrimental to its beneficial uses. By comparing CTR values with pollutant levels in historical discharges, the Regional Board is able to determine which discharges may have contributed to toxic chemical concentrations in marine water, marine life and sediment at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an elevated probability that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges did cause toxic chemical concentrations in marine water, marine life, and sediment, and/or did contribute to the present condition of pollution at the Shipyard Sediment Site, there exists an Industrial NPDES requirement violation.

While BAE Systems' Industrial NPDES Requirements did not provide specific numerical limitations for all possible chemicals, the Regional Board did require that discharges from BAE Systems not cause a violation of discharge prohibitions and receiving water limitations described in Section 3.6.5, above. Monitoring reports submitted by BAE Systems during the years 1992 through 1993 and 1996 through 1999, pursuant to the General Industrial NPDES Requirements for storm water discharges, indicate that elevated levels of chromium, copper, lead, nickel, and zinc were present in storm water discharged from the BAE Systems site when compared to levels established by the CTR for saltwater. Specific discharge violations are cited in Table 3-11, below.

[44] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

Table 3-11. Discharge Sample above CTR Value Occurring from 1992 to 1999

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 7, 1992	Chromium	0.34 mg/L	0.05 mg/L	Section 3.4 and 3.5	Unknown	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 7, 1992	Copper	0.37 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Unknown	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 7, 1992	Lead	0.34 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Unknown	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 7, 1992	Nickel	0.09 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Unknown	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 7, 1992	Zinc	2.25 mg/L	0.081 mg/L	Section 3.4 and 3.5	Unknown	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Cadmium	0.01 mg/L	0.0093 mg/L	Section 3.4 and 3.5	Discharge Point #4	Southwest Marine (SWM) 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 25, 1993	Chromium	0.22 mg/L	0.05 mg/L	Section 3.4 and 3.5	Discharge Point #1A	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Chromium	0.17 mg/L	0.05 mg/L	Section 3.4 and 3.5	Discharge Point #4	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Copper	1.97 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Discharge Point #1A	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Copper	0.77 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Discharge Point #4	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Lead	0.28 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Discharge Point #1A	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Lead	0.28 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Discharge Point #4	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 25, 1993	Nickel	0.04 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Discharge Point #4	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Zinc	3.17 mg/L	0.081 mg/L	Section 3.4 and 3.5	Discharge Point #1A	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1993	Zinc	2.49 mg/L	0.081 mg/L	Section 3.4 and 3.5	Discharge Point #4	SWM 1992-1993 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Chromium	0.07 mg/L	0.05 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Chromium	0.07 mg/L	0.05 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Copper	0.24 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1994	Copper	0.57 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Lead	0.61 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Lead	0.73 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Nickel	0.02 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Nickel	0.08 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 4, 1994	Zinc	2.75 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1994	Zinc	3.4 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Copper	1.55 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Copper	2.95 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Nickel	0.17 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Zinc	4.12 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 14, 1994	Zinc	5.45 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 19, 1995	Copper	1.26 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
April 19, 1995	Lead	0.24 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
April 19, 1995	Zinc	4.5 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 22, 1996	Copper	0.97 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 22, 1996	Lead	0.33 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 22, 1996	Nickel	0.27 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 22, 1996	Zinc	3.55 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 5, 1996	Copper	2.68 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 5, 1996	Lead	0.15 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 5, 1996	Nickel	0.21 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 5, 1996	Zinc	10.01 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 13, 1996	Copper	0.41 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 13, 1996	Lead	0.21 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 13, 1996	Nickel	0.06 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 13, 1996	Zinc	1.22 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
April 8, 1996	Copper	0.12 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
April 8, 1996	Lead	0.06 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
April 8, 1996	Nickel	0.07 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 8, 1996	Zinc	0.88 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Chromium	0.31 mg/L	0.05 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.12 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.52 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Copper	7.6 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.64 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 1997	Copper	0.99 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Copper	1.2 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Lead	0.057 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Lead	1.4 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Lead	0.021 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Lead	0.019 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 1997	Lead	0.04 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Nickel	0.017 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Nickel	0.018 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Nickel	0.022 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Nickel	0.032 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Nickel	0.042 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 1997	Nickel	0.083 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.38 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW4	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.91 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW1	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Zinc	1.4 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW6	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Zinc	2.5 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW3	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 10, 1997	Zinc	3.4 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW5	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 1997	Zinc	6.5 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW2	SWM 1996-1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Copper	0.45 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Copper	0.84 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Lead	0.018 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Lead	0.045 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Nickel	0.3 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 6, 1997	Nickel	0.3 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Zinc	2.95 mg/L	0.081 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
December 6, 1997	Zinc	0.64 mg/L	0.081 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Copper	0.62 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Copper	0.27 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Lead	0.029 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 29, 1998	Lead	0.022 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Nickel	0.2 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Zinc	0.83 mg/L	0.081 mg/L	Section 3.4 and 3.5	Pier 1	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 29, 1998	Zinc	0.56 mg/L	0.081 mg/L	Section 3.4 and 3.5	Pier 3	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Copper	0.2 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD3 & SD4	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Copper	0.2 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD10	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 3, 1998	Copper	1.6 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW03	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Lead	0.1 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SW03	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Zinc	3.0 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW 03	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Zinc	0.4 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD3 & SD4	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 3, 1998	Zinc	0.6 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD10	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 19, 1998	Copper	0.5 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW05	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 19, 1998	Copper	0.6 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW07	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 19, 1998	Zinc	1.1 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW05	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
February 19, 1998	Zinc	1.8 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW07	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 25, 1998	Copper	0.3 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SW03	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 25, 1998	Copper	1.2 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD23	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 25, 1998	Lead	0.1 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SD23	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 25, 1998	Zinc	0.9 mg/L	0.081 mg/L	Section 3.4 and 3.5	SW03	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
March 25, 1998	Zinc	1.7 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD23	SWM 1997-1998 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.35 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.67 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD3	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Copper	1.24 mg/L	0.0031 mg/L	Section 3.4 and 3.5	SD6	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Lead	0.027 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SD1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Lead	0.022 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SD3	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Lead	0.254 mg/L	0.0081 mg/L	Section 3.4 and 3.5	SD6	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Nickel	0.06 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SD1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Nickel	0.05 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SD3	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Nickel	0.14 mg/L	0.0082 mg/L	Section 3.4 and 3.5	SD6	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Zinc	1.80 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Zinc	2.14 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD3	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
November 8, 1998	Zinc	2.82 mg/L	0.081 mg/L	Section 3.4 and 3.5	SD6	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Copper	0.38 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Stormdrain #2	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Copper	0.44 mg/L	0.0031 mg/L	Section 3.4 and 3.5	Stormdrain #1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Lead	0.055 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Stormdrain #2	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Lead	0.126 mg/L	0.0081 mg/L	Section 3.4 and 3.5	Stormdrain #1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 25, 1999	Nickel	0.06 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Stormdrain #1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Nickel	0.05 mg/L	0.0082 mg/L	Section 3.4 and 3.5	Stormdrain #2	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Zinc	1.41 mg/L	0.081 mg/L	Section 3.4 and 3.5	Stormdrain #1	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1
January 25, 1999	Zinc	1.53 mg/L	0.081 mg/L	Section 3.4 and 3.5	Stormdrain #2	SWM 1998-1999 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3, and B. Receiving Water Limitations 1

[1] 40 CFR 131.38

[2] Reference to Section 3.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 3.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 3.4 and 3.5.

[3] The cited waste discharge requirement(s) can be found in Section 3.6 of this Technical Report.

3.10 Prior History of Enforcement Actions for Violations of NPDES Requirements

3.10.1 Administrative Civil Liability Orders

The Regional Board issued Complaint No. 89-02 for Administrative Civil Liability against BAE Systems (formerly known as Southwest Marine) in 1989. Site inspections were performed on November 8, 1988 and November 15, 1988 following a citizen complaint. Regional Board staff observed the discharge of abrasive grit waste and raw sewage to San Diego Bay on both occasions. The abrasive grit waste was sampled and analyzed and found to contain elevated concentrations of arsenic, chromium, lead, and zinc, and hazardous levels of copper. BAE Systems had not made an attempt to remove the sandblast grit. Regional Board staff also observed improper disposal of abrasive grit waste during inspections in 1986, 1987, and earlier in the year of 1988. A civil liability fine was imposed on Southwest Marine for $15,000.

In 2001, the Regional Board issued Complaint No. 2001-138 Administrative Civil Liability to BAE Systems for violation of the storm water runoff requirements of its NPDES permit. Storm water runoff samples at two locations exceeded the levels established by General NPDES Order No. 97-36 for copper and zinc. A civil liability fine of $12,664 was imposed.

3.10.2 Court Findings and Judgments Against BAE Systems

On April 30, 1996, the Natural Resources Defense Counsel, Inc.; San Diego Baykeeper, Inc.; and Kenneth J. Moser (hereinafter referred to as Plaintiffs) brought Clean Water Act (CWA) legal action in District Court against BAE Systems San Diego Ship Repair, Inc. (then known as Southwest Marine, Inc) claiming the facility was violating its NPDES requirements by discharging unlawful amounts of pollutants into San Diego Bay and failing to prepare and implement environmental compliance and monitoring plans required by CWA.

On September 7, 1999, the United States District Court, San Diego, California issued its findings of fact and conclusions of law. The court found: (1) that Plaintiffs had presented "convincing evidence" that Defendant had not made the required inspections that it claimed to have made; (2) that, even accepting BAE Systems' statement that it had made the required inspections, BAE Systems had not maintained adequate records of those inspections, with the result that a large number of inspection reports were missing; (3) that the reports that BAE Systems had provided demonstrated a pattern of poor housekeeping at BAE Systems' facility and showed that violations, when reported, were not always remedied in a timely manner; (4) that BAE Systems' inadequate implementation of its plans had led to "significant contributions of pollutants to BAE Systems' leasehold"; (5) that BAE Systems' leasehold within the Bay was "devoid of life"; (6) that the evidence conclusively demonstrated that substantial quantities of pollutants from BAE Systems' paint-blasting operations had entered San Diego Bay in BAE Systems' storm water discharges; (7) that BAE Systems' failure to implement its storm water plans adequately was contributing to and perpetuating the contamination of its marine leasehold; and (8) that the harm to BAE Systems' leasehold "could be remedied by BAE Systems with improved practices." Based on those findings, the court concluded: (1) that it had subject matter jurisdiction over the action; (2) that Plaintiffs had standing; (3) that BAE Systems had violated, and was continuing to violate, the relevant permits and plans; and (4) that BAE Systems' failure to implement its plans adequately was the result of "systemic problems" and "overall inadequacies" in implementation, rather than mere "snapshots" of isolated violations.

The findings and ruling was appealed to the Ninth Circuit Court of Appeals where the Circuit Judge held that: (1) individual citizen and citizen groups had standing to enforce provisions of the CWA; (2) CWA notice was sufficiently specific; (3) finding as to ongoing nature of BAE Systems' violations was not clearly erroneous; (4) injunctive relief granted by district court was consistent with, and complementary to, existing permit requirements, and was not abuse of discretion or usurpation of authority of executive branch; and (5) civil penalty of $799,000 was not excessive.

Finally, the findings and ruling was appealed to the United States Supreme Court via Petition for Writ of Certiorari where the appeal was denied.

3.11 Shipyard Industry-wide Historical Operational Practices

In November of 1997, the U.S. Environmental Protection Agency released a study titled "EPA Office of Compliance Sector Notebook Project: PROFILE OF SHIPBUILDING AND REPAIR INDUSTRY." According to the 1995 Toxic Release Inventory (TRI) data, the reporting shipbuilding and repair facilities released and transferred 39 different TRI chemicals for a total of approximately 6.5 million pounds of pollutants during calendar year 1995. These releases and transfers were dominated by volatile organic compounds (VOCs) and metal-bearing wastes, approximately 52 percent and 48 percent respectively (U.S. EPA, 1997c).

Releases to the air, water, and land have accounted for 37 percent (2.4 million pounds) of the shipyard's total reportable chemicals. Of these releases, over 98 percent were released to the air from fugitive (74.6 percent; 1,778,818 pounds) or point (24.1 percent; 574,097 pounds) sources, while approximately 1.2 percent (29,479 pounds), and were release directly to water (U.S. EPA, 1997c). However, a significant percentage of the total pollutants released as fugitive air or point air releases end up in the water, adding significantly to the 1.2 percent that is released directly to water.

VOCs accounted for about 86 percent of the shipyard's reported TRI releases. Xylenes, n-butyl alcohol, toluene, methyl ethyl ketone, and methyl isobutyl ketone account for about 65 percent of the industry's reported releases. These organic compounds are typically found in solvents that were used extensively by the industry in thinning paints and for cleaning and degreasing metal parts and equipment (U.S. EPA, 1997c).

The remainder of the releases was primarily metal-bearing wastes. Copper, zinc, and nickel-bearing wastes accounted for about 14 percent of the industry's reported releases. These pollutants were released primarily as fugitive emissions during metal plating operations and as overspray in painting operations and could also have been released as fugitive dust emissions during blasting operations (U.S. EPA, 1997c).

4. Finding 4: City of San Diego

The City of San Diego owns and operates a municipal separate storm ~~water conveyance~~ sewer system (MS4) through which it discharges pollutants commonly found in urban runoff to San Diego Bay subject to the terms and conditions of a NPDES Storm Water Permit. The City of San Diego has caused or permitted the discharge of urban storm water pollutants directly to San Diego Bay at the Shipyard Sediment Site, in violation of waste discharge requirements. The waste includes ~~ing~~ metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), total suspended solids, sediment (due to anthropogenic activities), petroleum products, and synthetic organics (pesticides, herbicides, and PCBs) through its SW4 (located on the ~~Southwest Marine~~ BAE Systems leasehold) and SW9 (located on the NASSCO leasehold) MS4 conduit pipes. ~~as well as other MS4 conduit pipes which historically discharged directly into the Shipyard Sediment Site.~~ The City of San Diego has also caused or permitted the discharge of these urban storm water pollutants in violation of waste discharge requirements, through its MS4 to Chollas Creek resulting in the exceedances of chronic and acute California Toxics Rule copper, lead, and zinc criteria for the protection of aquatic life, in violation of waste discharge requirements prescribed by the Regional Board. ~~U.S. Navy s~~ Studies indicate that during storm events, storm water plumes toxic to marine life and containing urban storm water pollutants, emanate from Chollas Creek ~~discharges sediment plumes, containing urban storm water pollutants,~~ up to ~~2~~ 1.2 kilometers into San Diego Bay, ~~including~~ and contribute to pollutant levels at the Shipyard Sediment Site. The urban storm water pollutants in the on-site and off-site MS4 discharges have contributed to the accumulation of pollutants in the marine sediment~~s~~ at the Shipyard Sediment Site to levels, which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations the City of San Diego is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

4.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that the City of San Diego should be named as a discharger in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

4.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code Section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code Section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies’ records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

4.3 The City of San Diego Owns and Operates a Municipal Separate Storm Sewer System (MS4) Through Which It Discharges Urban Runoff

4.3.1 MS4 Description

The City of San Diego (City) owns and operates an MS4 conveyance through which it discharges urban runoff into waters of the United States within the San Diego Region. The City's MS4 conveys urban runoff from approximately 237 square miles of urbanized area and includes more than 39,000 storm drain structures and over 900 miles of storm drain pipes and channels.

The City of San Diego owns and operates the following MS4 storm drains which convey urban runoff from source areas upgradient of NASSCO's and BAE Systems' property and discharge directly or indirectly into San Diego Bay within the NASSCO and BAE Systems leasehold:

- **City of San Diego, Chollas Creek MS4 Storm Drains**
  The City of San Diego owns and operates approximately 816 MS4 storm drain outfalls[45] which convey urban runoff into Chollas Creek, a tributary of San Diego Bay, upstream of the NASSCO and BAE Systems leaseholds. The City's MS4 urban runoff discharges into Chollas Creek contribute to the elevated pollutant concentrations found at the downstream Shipyard Sediment Site. The mouth of Chollas Creek is immediately adjacent to the southern boundary of the Shipyard Sediment Site. Available studies (Schiff, 2003, Katz et al., 2003; Chadwick et al., 1999) indicate that stormwater plumes emanating from Chollas Creek outflow to San Diego Bay are toxic to marine life and introduce suspended solids, copper, zinc, and lead to the Shipyard Sediment Site through settling of particles.
- **City of San Diego MS4 Storm Drain SW4**
  The storm drain outfall identified as SW4 in the Shipyard Report (Exponent, 2003) enters BAE Systems leasehold with two contributing storm pipes located at the foot of Sampson and Sicard Streets. These pipes join together somewhere beneath BAE Systems' leasehold, ultimately discharging into San Diego Bay at the SW4 outfall located at a point between Piers 3 and Pier 4 on the BAE Systems leasehold[46] at the Shipyard Sediment site. This storm drain receives runoff from Sicard, Belt, and Sampson streets. Figure 4-1 shows the storm drain outfalls at the BAE Systems' leasehold.

[45] Zirkle, Chris, Deputy Director, City of San Diego, 2006. Letter to John Robertus, Regional Board Executive Officer, regarding "Comments on the Total Maximum Daily Load for Indicator Bacteria, Project I- Beaches and Creeks in the San Diego Region." Page 9. February 3, 2006.

[46] A 1968 City of San Diego drainage easement figure shows a 42-inch storm drain, discharging into the Bay between Piers 3 and 4. No further information was provided by the City of San Diego concerning the SW4 outfall.

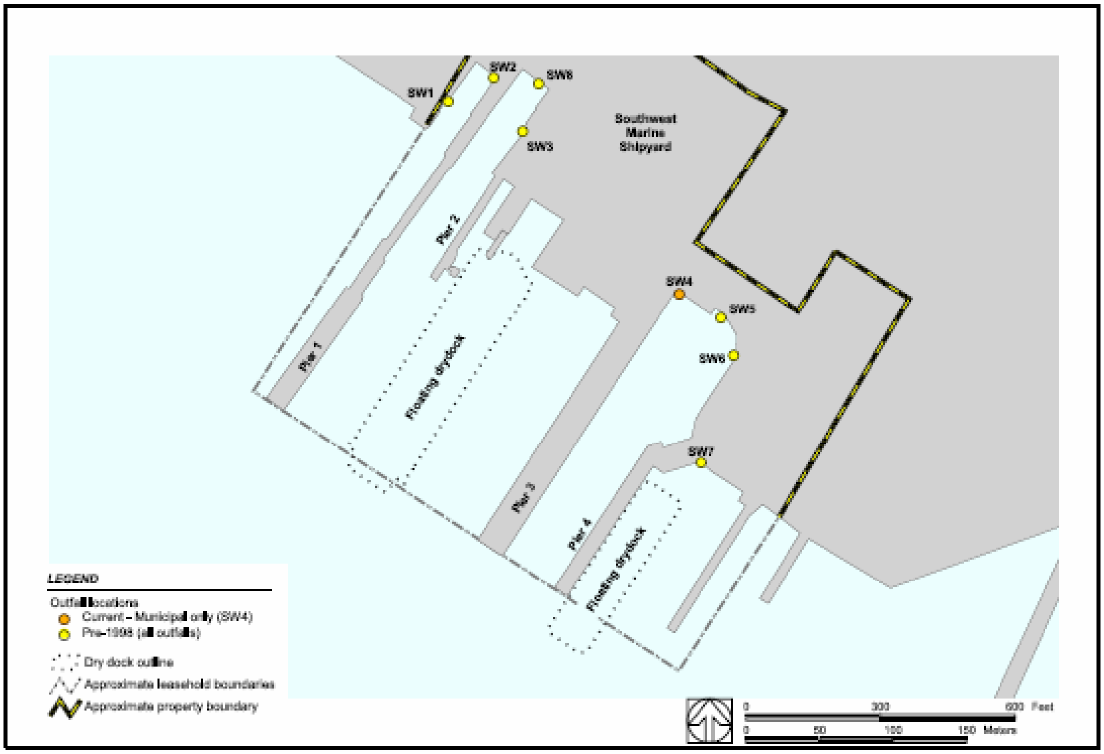

Figure 4-1. Storm Drain Outfalls at BAE Systems' Leasehold
(Exponent, 2003)

- **City of San Diego MS4 Storm Drain SW9**
  This storm drain outfall is identified as SW9 in the Shipyard Report (Exponent, 2003) and enters NASSCO's leasehold at the foot of 28th Street and discharges at the southeasterly corner of the leasehold into Chollas Creek, a tributary of San Diego Bay. (Exponent, 2003; ENV America, 2004a; City of San Diego, 2004a) Storm Drain SW9 collects flow from 28th Street, and stretches from the I-5 freeway to the bay including parts of Belt Street and Harbor Drive. Figure 4-2 shows the storm drain outfalls at NASSCO's leasehold.

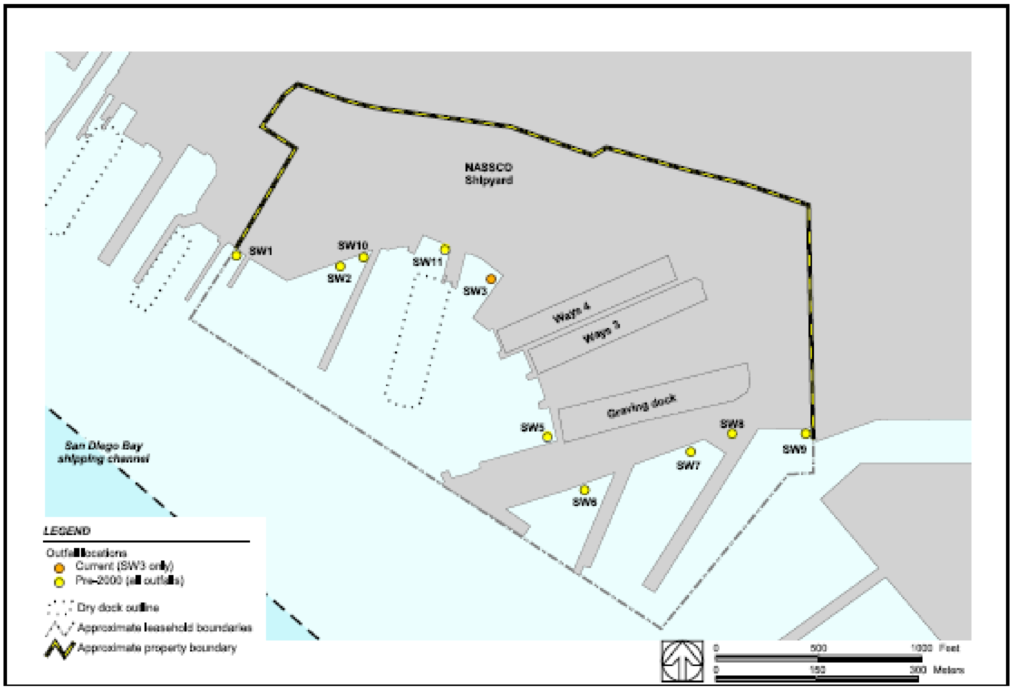

Figure 4-2. Storm Drain Outfalls at NASSCO's Leasehold
(Exponent, 2003)

4.3.2 Urban Runoff is a "Waste" and a "Point Source Discharge" of Pollutants

Urban runoff is a waste, as defined in the Water Code that contains pollutants and adversely affects the quality of the waters of the State.[47] The discharge of urban runoff from an MS4 conveyance is a "discharge of pollutants from a point source" into waters of the United States as defined in the Clean Water Act.[48]

[47] See California Water Code (CWC) Section 13050(d). Waste includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal.

[48] 40 CFR 122.2 defines "point source" as "any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff." 40 CFR 122.2 defines "discharge of a pollutant" as "Any addition of any 'pollutant' or combination of pollutants to 'waters of the United States' from any point source."

The most common categories of pollutants in urban runoff include total suspended solids (TSS), sediment (due to anthropogenic activities), pathogens (e.g., bacteria, viruses, protozoa), heavy metals (e.g., copper, lead, zinc, and cadmium), petroleum products and polynuclear aromatic hydrocarbons (PAHs and HPAHs), synthetic organics (e.g., pesticides, herbicides, and PCBs), nutrients (e.g., nitrogen and phosphorus fertilizers), oxygen-demanding substances (decaying vegetation, animal waste), and trash.[49]

4.4 The City of San Diego Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirement

The City of San Diego has caused or permitted the discharge of urban storm water pollutants directly to San Diego Bay at the Shipyard Sediment Site. The pollutants include metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), TSS, sediment (due to anthropogenic activities), petroleum products, and synthetic organics (pesticides, herbicides, and PCBs) through its SW4 (located on the BAE Systems leasehold) and SW9 (located on the NASSCO leasehold) MS4 conduit pipes. The City of San Diego has also caused or permitted the discharge of these urban storm water pollutants through its MS4 conveyance to Chollas Creek resulting in the exceedances of chronic and acute California Toxics Rule copper, lead, and zinc criteria for the protection of aquatic life, in violation of waste discharge requirements prescribed by the Regional Board.

Urban runoff discharges from the City of San Diego's MS4 are regulated under NPDES requirements prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. The City of San Diego must comply with all conditions of the NPDES requirements. Any noncompliance of NPDES requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304. Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides, in relevant part, that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement…"

The City of San Diego's NPDES Permit requirement urban runoff discharges are documented in the Regional Board records via monitoring reports (filed by the *San Diego County Municipal Copermittees*). The City of San Diego's urban runoff discharges in violation of waste discharge requirements are presented below in Section 4.7 of this Technical Report.

[49]Finding 7 of Order No.2001-001, NPDES No. CAS0108758, Waste Discharge Requirements For Discharges Of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities Of San Diego County, and the San Diego Unified Port District.

4.5 The City of San Diego Discharged Waste to San Diego Bay Creating a Condition of Pollution, Contamination, and Nuisance Conditions in San Diego Bay

The City of San Diego has contributed to the accumulation of pollutants in marine sediment at the Shipyard Sediment Site by discharging urban storm water pollutants from MS4 discharges to levels, which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Water Code section 13304 requires that any person who causes any waste to be discharged, or deposited where it probably will be discharged, into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance is subject to cleaning up or abating the effects of the waste.

The Porter-Cologne Water Quality Act defines “pollution” as “an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects… …the waters for beneficial uses …”[50] “Contamination” is defined as “an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. “Contamination” includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.”[51]

Pollutants conveyed and discharged by the MS4 conveyance include metals, TSS, sediment, petroleum products, pesticides, herbicides, and PCBs. Many of these same pollutants are present in marine sediment at the Shipyard Sediment Site in highly elevated concentrations as compared to sediment chemistry levels found at off-site reference stations located in areas of San Diego Bay.[52]

As stated above, since 1990 the City Of San Diego’s NPDES requirements have specifically prohibited urban runoff discharges that cause pollution, contamination or nuisance conditions in San Diego Bay or otherwise cause or contribute to violations of San Diego Bay water quality standards.

Based on the evidence presented in Section 4.7 of this Technical Report, the City of San Diego has a history of discharging pollutants from MS4 Storm Drains SW4, SW9, and Chollas Creek, to the Shipyard Sediment Site at levels that have contributed to a condition of pollution, contamination, or nuisance at the Shipyard Sediment Site. As described in Sections 12 through 29 of this Technical Report these same pollutants in the discharges have accumulated in San Diego Bay sediment at levels that:

[50] Water Code section 13050(1).

[51] Water Code section 13050(k).

[52] See Section 15 of this Technical Report.

1. Adversely affect the beneficial uses of San Diego Bay, violating a NPDES requirement prohibitions pertaining to discharges that cause pollution, contamination, or nuisance conditions in San Diego Bay; and
2. Violate NPDES requirements pertaining to discharges that degrade marine communities, cause adverse effects on the environment or the public health, or result in harmful concentrations of pollutants in marine sediment.

Accordingly, it is concluded that the City of San Diego has caused or permitted the discharge of waste to San Diego Bay in a manner causing the creation of pollution or nuisance conditions and that it is appropriate for the Regional Board to issue a cleanup and abatement order naming the City of San Diego as a discharger pursuant to Water Code section 13304.

Further discussion on pollution, contamination, and nuisance are available in Sections 1.4 and 1.5 of this Technical Report.

4.6 NPDES Requirement Regulation

Urban runoff discharges from the City of San Diego's MS4 are regulated under NPDES requirements prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. These requirements are referred to as either NPDES requirements[53] or by the federal terminology "NPDES Permit." The City of San Diego's first NPDES requirements started in 1990, when the Regional Board issued WDRs for storm water and urban runoff. A listing of the successive NPDES requirements adopted by the Regional Board to regulate the City of San Diego's MS4 Urban Runoff discharges is provided in Table 4-1 below.

[53] Pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Act, to avoid the issuance by the United States Environmental Protection Agency of separate and duplicative NPDES permits for discharges in California that would be subject to the Clean Water Act, the State's Waste Discharge Requirements (WDRs) for such discharges implement the NPDES regulations and entail enforcement provisions that reflect the penalties imposed by the Clean Water Act for violation of NPDES permits issued by the U.S. EPA. Thus, the State's WDRs that implement federal NPDES regulations (NPDES requirements) serve in lieu of NPDES permits.

Table 4-1. City of San Diego NPDES Permits

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 90-42 NPDES No. CA0108758	Waste Discharge Requirements For Stormwater and Urban Runoff from the County of San Diego the Incorporated Cities of San Diego County and the San Diego Unified Port District	July 16, 1990	February 21, 2001
Order No. 2001-01, NPDES No. CAS0108758	Waste Discharge Requirements For Discharges Of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cites of San Diego County, and the Unified Port District	February 21, 2001	Present

The City of San Diego must comply with all conditions of the NPDES requirements. Any noncompliance of NPDES requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304.

Each of the City of San Diego’s successive NPDES requirements described here has specifically prohibited urban runoff discharges that cause pollution, contamination or nuisance conditions in San Diego Bay, or otherwise cause or contribute to violations of San Diego Bay water quality standards.

4.6.1 Order No. 90-42, NPDES No. CA0108758

Order 90-42, NPDES No. CA0108758, in effect from July 16, 1990 to February 21, 2001, contains the following narrative limits that relate to the discussions contained herein:

- VIII. ILLICIT CONNECTION/ILLEGAL DUMPING DETECTION PROGRAM B. The permittee shall effectively eliminate all identified illegal/illicit discharges in the shortest time practicable, and in no case later than July 16, 2005… …If it is determined that any of the preceding discharges cause or contribute to violations of water quality standards or are significant contributors of pollutants to waters of the United States, the discharges shall be prohibited form entering storm water conveyance systems; and

- XIII. PROVISIONS A. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined by section 13050 of the Water Code.

4.6.2 Order No. 2001-01, NPDES No. CAS0108758

Order No. 2001-01, NPDES No. CAS0108758, in effect from February 21, 2001 contains the following provisions that relate to the discussions contained herein:

- A. PROHIBITIONS – DISCHARGES … 1. Discharges into and from MS4s in a manner causing, or threatening to cause, a condition of pollution, contamination, or nuisance (as defined in CWC § 13050), in waters of the state are prohibited.
- A. PROHIBITIONS DISCHARGES … 2. Discharges from MS4s which cause or contribute to exceedances of receiving water quality objectives for surface water or groundwater are prohibited.
- C. RECEIVING WATER LIMITATIONS … 1. Discharges from MS4s that cause or contribute to the violation of water quality standards (designated beneficial uses and water quality objectives developed to protect beneficial uses) are prohibited.

The above NPDES requirement narrative limits are applicable to urban runoff discharges to San Diego Bay from the City of San Diego MS4 Storm Drains SW4, SW9, and Chollas Creek, which occurred during the effective term of Order Nos. 90-42 and 2001-01.

4.7 City of San Diego's NPDES Waste Discharges

4.7.1 City of San Diego, Chollas Creek MS4 Storm Drain Discharges

As described in Section 4.3.1, above, the City of San Diego owns and operates approximately 816 MS4 storm drains that convey urban runoff into Chollas Creek, a tributary of San Diego Bay, upstream of the NASSCO and BAE Systems leaseholds. The mouth of Chollas Creek is immediately adjacent to the southern extremity of the Shipyard Sediment Site. Available studies (Schiff, 2003; Katz et al., 2003; Chadwick et al., 1999) indicate that the storm water plumes emanating from Chollas Creek to San Diego Bay during storm events are toxic to marine life and can introduce a large fraction of the total storm event's production of suspended solids, copper, zinc, and lead to the Shipyard Sediment Site through settling of particles.

4.7.1.1 NPDES Requirement Violations in Chollas Creek Monitoring Reports

The *San Diego County Municipal Copermittees 2002-2003 Urban Runoff Monitoring Final Report* submitted by the City of San Diego indicates that elevated levels of zinc, copper, and lead are present in the urban runoff outflow discharged from Chollas Creek into San Diego Bay. This sampling information indicates that zinc, copper, and lead are discharged at levels that are elevated compared to levels established by the California Toxics Rule (CTR) for saltwater[54].

The numerical water quality criteria values in CTR were not included as numerical effluent limitations in the NPDES requirements issued to the City. However, the numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in water is detrimental to its beneficial uses. By comparing CTR values with pollutant levels found in historical discharges, the Regional Board is able to determine which discharges *may* have contributed to a condition of pollution, contamination, or nuisance at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an *elevated probability* that those same discharges are presently contributing to the condition of pollution, contamination, or nuisance at the Shipyard Sediment Site. In retrospect, to the extent that those historical, elevated discharges *did* contribute to the condition of pollution, contamination, or nuisance at the Shipyard Sediment Site in the past, and/or *did* contribute to the present condition of pollution at the Shipyard Sediment Site, there exists an NPDES violation of the requirements cited in Section 4.6 of this Technical Report.

While not providing specific numerical effluent limitations for all possible chemicals, the Regional Board did require an NPDES requirement condition that the City's urban runoff discharges not cause or threaten to cause, a condition of pollution, contamination, or nuisance.

To the extent that the City's urban runoff discharges in Chollas Creek were elevated above CTR criteria values and caused or threatened to cause, a condition of pollution, contamination, or nuisance by contributing to the pollutants at the Shipyard Sediment Site, and/or contributed to the present condition of pollution at the Shipyard Sediment Site, the following specific discharges listed in Table 4-2 are violations of A. Prohibitions – Discharges 1 and 2 and C. Receiving Water Limitation 1 of Order No. 2001-01, NPDES Permit No. CAS0108758.

[54] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

Table 4-2. Discharge Samples above CTR Values Occurring from 2001 to 2003

Date	Constituent	Urban Runoff Pollutant Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Source	Citation[3]
November 8, 2002	Copper	0.028 mg/L	0.0031 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition - Discharges 1 and 2, and C. Receiving Water Limitations 1
November 8, 2002	Lead	0.017 mg/L	0.0081 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition - Discharges 1 and 2, and C. Receiving Water Limitations 1
November 8, 2002	Zinc	0.118 mg/L	0.081 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition - Discharges 1 and 2, and C. Receiving Water Limitations 1
February 11, 2003	Copper	0.033 mg/L	0.0031 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition - Discharges 1 and 2, and C. Receiving Water Limitations 1
February 11, 2003	Lead	0.029 mg/L	0.0081 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition - Discharges 1 and 2, and C. Receiving Water Limitations 1

Date	Constituent	Urban Runoff Pollutant Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Source	Citation[3]
February 25, 2003	Copper	0.016 mg/L	0.0031 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition Discharges 1 and 2, and C. Receiving Water Limitations 1
February 25, 2003	Lead	0.023 mg/L	0.0081 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition Discharges 1 and 2, and C. Receiving Water Limitations 1
February 25, 2003	Zinc	0.23 mg/L	0.081 mg/L	Sections 4.4 and 4.5	2002 - 2003 Monitoring Report	Order No. 2001-01, A. Prohibition Discharges 1 and 2, and C. Receiving Water Limitations 1

[1] 40 CFR 131.38

[2] Reference to Section 4.4 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 4.5 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 4.4 and 4.5.

[3] The cited waste discharge requirement(s) can be found in Section 4.6 of this Technical Report.

4.7.1.2 Chollas Creek Metals Total Maximum Daily Loads (TMDL)

Chollas Creek was placed on the Clean Water Act (CWA) section 303(d) List of Water Quality Limited Segments (List of Water Quality Limited Segments) in 1996 for the metals cadmium, copper, lead and zinc.

On June 29, 2005 the Regional Board adopted a TMDL for metals in Chollas Creek.[55] This TMDL provides additional evidence that concentrations of dissolved copper, lead, and zinc in Chollas Creek waters have frequently exceeded numeric water quality criteria values contained in the CTR. Furthermore, in a Toxicity Identification Evaluation performed in 1999, Chollas Creek storm water concentrations of zinc and to a lesser extent copper were identified as causing or contributing to reduced fertility in the purple sea urchin.[56]

Urban runoff discharges from the City of San Diego's MS4 are considered to be one of the leading causes of receiving water quality impairments in the Chollas Creek Watershed. Storm water samples from Chollas Creek collected by various sources between 1994 and 2003 frequently exceeded CTR freshwater quality criteria for copper, lead, and zinc (Table 4-3).

[55] See Regional Board Resolution No. R9-2005-0111, A Resolution Adopting An Amendment To The Water Quality Control Plan For The San Diego Region To Incorporate Total Maximum Daily Loads For Dissolved Copper, Lead, And Zinc In Chollas Creek, Tributary To San Diego Bay, June 29, 2005. See also Regional Board Technical Report, Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005.

[56] Regional Board Resolution No. R9-2005-0111. Footnote 7, supra. Finding 8.

Table 4-3. Chollas Creek CTR Exceedances[57]

COPPER			Concentrations reported in µg / L				# of exceedances (CTR) [D]	
Collection Dates	Organization	n	min	max	mean	median	CMC	CCC
Feb 94 - Feb 03	MS4 Copermittees	58	2.5 [A]	81.6 [B]	16.4 [C]	11.0 [C]	16 of 32	20 of 32
Feb - Apr, 00	Caltrans	4	5.1	11	7.8	7.5	NA [E]	NA [E]
Feb - Mar, 00	SCCWRP	2	51.2	63	57.1	57.1	NA [E]	NA [E]
Jan , Feb & Nov, 01	DPR	14	5	34	11.7	9.8	5 of 12	7 of 12
Sep-00	ES Babcock	4	1.92	28.8	9.8	4.3	NA [G]	NA [G]
Mar - Apr 99	SCCWRP (TIE)	3	10	30	18.3	15	2 of 3	3 of 3
Jun 91 & Mar 92	Regional Board	5	3	8	6.4	7	0 of 5	0 of 5
LEAD			Concentrations reported in µg / L				# of exceedances (CTR) [D]	
Collection Dates	Organization	n	min	max	mean	median	CMC	CCC
Feb 94 - Feb 03	MS4 Copermittees	57	1.0 [A]	118 [B]	16.4 [C]	3.0 [C]	0 of 19	10 of 19
Feb - Apr, 00	Caltrans	4	2.9	11	5.5	4	NA [E]	NA [E]
Jan , Feb & Nov, 01	DPR	14	1.0 [A]	46	7.3	2	1 of 12	6 of 12
Sep-00	ES Babcock	4	2.0 [A]	4.1	1.9	1.2	NA [G]	NA [G]
Mar - Apr 99	SCCWRP (TIE)	3	10.0 [A]	82	39	30	1 of 2	2 of 2
Jun 91 & Mar 92	Regional Board	5	5.0 [A]	29	12.2	11	0 of 3	1 of 3
ZINC			Concentrations reported in µg / L				# of exceedances (CTR) [D]	
Collection Dates	Organization	n	min	max	mean	median	CMC	CCC
Feb 94 - Feb 03	MS4 Copermittees	57	8	548 [B]	105.6 [C]	73 [C]	12 of 42	12 of 42
Feb - Apr, 00	Caltrans	4	17	42	28.8	28	NA [E]	NA [E]
Feb - Mar, 00	SCCWRP	2	146	150.8	148.4	148.4	NA [E]	NA [E]
Jan , Feb & Nov, 01	DPR	14	16.8	370	137.6	105	7 of 12	7 of 12
Sep-00	ES Babcock/RB	4	10.0 [A]	45	21.3	17.5	NA [G]	NA [G]
Mar - Apr 99	SCCWRP (TIE)	3	90	220	173.3	210	2 of 3	2 of 3
Jun 91 & Mar 92	Regional Board	5	3	188	45	11	0 of 5	1 of 5

[A] sample below Reporting Limit
[B] calculated from total concentration
[C] using all samples (measured dissolved and calculated from total). Samples below detection limit entered as 1/2 detection limit for calculations
[D] considering only measured dissolved concentrations and samples not below DL or RL. (number in parenthesis represents available sample pool under these criteria)
[E] no associated hardness values available
[F] all samples reported as "less than"
[G] all dissolved samples calculated from total

[57]From the Regional Board Technical Report, Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005.

4.7.1.3 Chollas Creek Outflow Plume

Chollas Creek, a tributary of San Diego Bay, is an urban creek with highly variable flows. The highest flow rates are associated with storm events. Extended periods with no surface flows occur during dry weather, although pools of standing water may be present. Much of the creek has been channelized and concrete lined, but some sections of earthen creek bed remain. The mouth of the creek is located on the eastern shoreline of central San Diego Bay. San Diego Bay, at the mouth of Chollas Creek, is on the List of Water Quality Limited Segments for sediment toxicity and degraded benthic community impairments. The mouth of Chollas Creek is immediately adjacent to the southern boundary of the Shipyard Sediment Site. Based on the considerations discussed below the Regional Board concludes that storm water outflows from Chollas Creek has contributed to the accumulation of pollutants in marine sediment at the Shipyard Sediment Site. These considerations also provide additional evidence that violations of the NPDES requirements cited in Section 4.6 have occurred and are continuing to occur.

Chollas Creek provides significant freshwater flow, and elevated suspended solids and chemical pollutant loading into San Diego Bay. Urban runoff from Chollas Creek has been shown to be toxic to both saltwater and freshwater organisms. In-channel wet-weather monitoring from previous storm seasons showed that samples of Chollas Creek stormwater were toxic to the water flea (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*), and the purple sea urchin (*Strongylocentrotus purpuratus*). A study conducted by Southern California Coastal Research Project (SCCWRP) in 2001 to establish the linkage between the Chollas Creek in-channel toxicity measurements and potential impairments in the receiving water of San Diego Bay, (Schiff, 2003), concluded that:

- Stormwater plumes from Chollas Creek extended over an area of 2 km^2 in San Diego Bay. The study observed that stormwater plumes emanating from Chollas Creek extended between 0.02 and 2.25 km^2 over San Diego Bay during small to moderately-sized storm events. Plumes were easily distinguished using salinity as a conservative tracer of wet weather inputs. Turbidity was also a good tracer of the plume.
- Toxicity extended up to 1 km from the Creek mouth and was proportional to the amount of runoff dilution. The SCCWRP study measured toxicity using the purple sea urchin (*Strongylocentrotus purpuratus*) fertilization test in both stormwater samples taken from the creek and samples taken from the stormwater plume in San Diego Bay. This toxicity varied across the gradient of plume influence and was well correlated with the amount of stormwater present in the sample. All samples were salinity adjusted before toxicity testing, so the gradient in toxicity appears to be a function of toxicants present in the stormwater discharges.

- The toxic part of the plume was smaller than the salinity signal. Although toxicity was measured in the stormwater plume emanating from Chollas Creek, the entire plume was not toxic. In the two storms that were mapped from this study, the toxic portion of the plume was approximately 25% to 50% of the plumes' salinity signal. This reduction in the spatial extent of plume toxicity was likely due to dilution and mixing of the plume in the Bay.
- In-channel and plume toxicity was primarily due to trace metals including zinc and copper. TIEs conducted on stormwater samples from both the Creek and from the stormwater plume in the Bay identified dissolved trace metals, predominantly zinc, as the toxicant responsible for the majority of toxicity. Toxicity was eliminated by the addition of the metal chelating agent EDTA. Concentrations of dissolved zinc, and to a lesser extent copper, were high enough in the tested samples to account for the observed toxicity.

U.S. Navy studies (Katz et al., 2003; Chadwick et al., 1999) indicate that the Chollas Creek outflow (plume) to San Diego Bay can introduce pollutants to the Shipyard Sediment Site. The U.S. Navy funded a project in 2001 to quantify storm event mass loading of pollutants from upstream MS4/creek sources and from near-bay Navy sources as well as to characterize the spatial and temporal impacts from the plumes generated in the bay. Specific conclusions of the study Katz et al., 2003, include:

- During a single storm event in February 2001, the sediment plume containing pollutants from Chollas Creek was measured to cover an area up to 1.2 km away from the mouth of Chollas Creek.
- Storm water plumes developed off Chollas Creek quickly after the start of rainfall and were dispersed through tidal mixing 12 hours after run off ceased.
- Plume evolution in the bay was well tracked by all real-time measurement parameters though most clearly with salinity, light transmission, and oil fluorescence.
- Contaminants were primarily associated with particles and their strong association with total suspended solids (TSS) provides a good first order approximation for their distribution.
- Storm water is a continuing source of excessive levels of lead, zinc, chlordane, DDT, and PCBs, and possibly for TPAH and mercury to sediment at the mouth of the Chollas Creek.

The City of San Diego's own review of data suggests that Chollas Creek may be a localized source for metals in the Bay (City of San Diego, 2004a, b). The City's enforcement action against a metal plating shop is evidence of upstream industrial discharge to Chollas Creek, which discharges directly to the Bay (City of San Diego, 2004a, b).

4.7.2 City of San Diego, MS4 Storm Drain SW4 Violations

As described in Section 4.3.1, the City of San Diego owns and operates an MS4 storm drain identified as SW4 in the Shipyard Report (Exponent, 2003) (see Figure 4-1 above) which conveys urban runoff from source areas upgradient of BAE Systems' property and discharges directly within the BAE Systems leasehold. Urban runoff discharged into the SW4 storm drain outfall is subject to the NPDES requirements cited in Section 4.6. Although no monitoring data is available for this outfall, it is highly probable that historical and current discharges from this outfall have discharged heavy metals and organics to San Diego Bay at the Shipyard Sediment Site.[58]

Recent evidence of illicit discharges from the City of San Diego's Storm Drain SW4 into the Shipyard Sediment Site is provided by the results of a recent sampling investigation conducted by the City of San Diego. On October 3, 2005, the City of San Diego conducted an investigation and observed evidence of an illegal discharge into the SW4 MS4 catch basin on the north side of Sampson Street between Belt Street and Harbor Drive, approximately 10 feet east of the railroad line that runs parallel with Belt Street. Specifically, the catch basin is located immediately to the east of the BAE Systems' parking lot and the SDG&E Silver Gate Power Plant, which is adjacent to the parking lot. During the City's investigation, three sediment samples were collected and analyzed for PCBs and PAHs. The first sample was collected from inside and at the base of a six-inch lateral entering the catch basin from the east. The second sample was collected from inside and at the base of the 12-inch lateral entering the catch basin from the north. The third sample was collected from the 18-inch pipe exiting the catch basin. The results of these three samples, presented in Table 4-4 below, indicate the presence of both PCBs and PAHs entering and exiting the municipal storm drain system catch basin and resulted in the City of San Diego issuing a Notice of Violation (NOV) to SDG&E (Zirkle, 2005a; Kolb, 2005b).

[58] See Section 4.3.2 for a description of the most common categories of pollutants found in urban runoff .

Table 4-4. City of San Diego MS4 Sediment Sample Results for PCBs and PAHs on October 3, 2005

Constituent	Effects Range-Low (ERL)[1] µg/kg	Effects Range-Median (ERM)[1] µg/kg	Alternative Sediment Cleanup Levels µg/kg	6" Lateral µg/kg	12" Lateral µg/kg	Catch Basin µg/kg
Aroclor-1016				< 50	< 50	< 50
Aroclor-1221				< 50	< 50	< 50
Aroclor-1232				< 50	< 50	< 50
Aroclor-1242				< 50	< 50	< 50
Aroclor-1248				< 50	< 50	< 50
Aroclor-1254				650	130	260
Aroclor-1260				720	120	360
Aroclor-1262				< 50	< 50	< 50
Sum of Aroclors®	22.7[2]	180[2]	420[3]	**1,370**	**250**	**620**
Naphthalene[4]	160	2,100		70	330	170
Acenaphthylene[4]	44	640		< 50	< 50	< 50
Acenaphthene[4]	16	500		< 50	< 50	< 50
Fluorene[4]	19	540		< 50	< 50	< 50
Phenanthrene[4]	240	1,500		210	140	< 50
Anthracene[4]	85.3	1,100		< 50	< 50	< 50
Fluoranthene[5]	600	5,100		< 50	< 50	3,300
Pyrene[5]	665	2,600		500	170	91
Benzo [a] Anthracene[5]	261	1,600		450	< 50	< 50
Chrysene[5]	384	2,800		210	65	< 50
Benzo [b] Fluoranthene[5]	NA	NA		260	67	< 50
Benzo [k] Fluoranthene[5]	NA	NA		160	110	< 50
Benzo [a] Pyrene[5]	430	1,600	1,010	130	59	< 50
Dibenz [a,h] Anthracene[5]	63.4	260		< 50	< 50	< 50
Benzo [g,h,i] Perylene[5]	NA	NA		< 50	< 50	< 50
Indeno [1,2,3-c, d] Pyrene[5]	NA	NA		93	< 50	< 50
Total PAHs	4,022	44,792		**2,083**	**941**	**3,391**

(1) Long et al., 1995. See Section 34.2.4.1 for discussion of ERMs and ERLs.
(2) ERL and ERM levels are for Total PCBs
(3) Cleanup level is for Total PCB Congeners
(4) LPAH – low molecular weight polynuclear aromatic hydrocarbon
(5) HPAH – high molecular weight polynuclear aromatic hydrocarbon
Non-detections are represented as less than the reporting limit.
(CEL, 2005)

The City of San Diego MS4 Storm Drain SW4 discharges into the BAE Systems leasehold between Piers 3 and 4. Sample stations from the Detailed Sediment Investigation (Exponent, 2003) in the area of this outfall include SW20 through SW25. The sample results for PCBs and PAHs are presented in Table 4-5.

Table 4-5. NASSCO & Southwest Marine Detailed Sediment Investigation PCB and PAH Results for SW20 through SW25

Constituent	SW20 µg/kg	SW21 µg/kg	SW22 µg/kg	SW23 µg/kg	SW24 µg/kg	SW25 µg/kg
Aroclor-1016	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1221	< 500	< 520	< 57	< 58	< 460	< 51
Aroclor-1232	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1242	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1248	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1254	1,500	1,600	670	550	790	330
Aroclor-1260	1,600	1,800	790	710	870	380
Sum of Aroclors®	**3,100**	**3,400**	**1,500**	**1,300**	**1,700**	**710**
Naphthalene(1)	< 13	13	31	< 15	26	< 13
Acenaphthylene(1)	120	130	150	130	290	180
Acenaphthene(1)	16	14	17	19	14	13
Fluorene(1)	53	53	56	53	220	45
Phenanthrene(1)	300	220	330	360	810	260
Anthracene(1)	450	370	500	500	6,000	440
Fluoranthene(2)	930	580	910	960	7,100	750
Pyrene(2)	1,200	850	1,100	1,000	3,100	940
Benzo [a] Anthracene(2)	760	650	890	850	6,300	710
Chrysene(2)	1,800	1,400	1,900	1,800	11,000	1,300
Benzo [b] Fluoranthene(2)	1,500	1,600	1,800	1,500	7,000	2,000
Benzo [k] Fluoranthene(2)	1,200	1,100	1,300	1,200	7,300	1,600
Benzo [a] Pyrene(2)	1,400	1,500	1,700	1,500	8,800	2,000
Dibenz [a,h] Anthracene(2)	200	210	230	220	1,100	240
Benzo [g,h,i] Perylene(2)	770	780	830	820	2,800	800
Indeno [1,2,3-c, d] Pyrene(2)	970	990	1,100	1,000	3,700	1,100
Total PAHs	**11,669**	**10,460**	**12,844**	**11,912**	**65,560**	**12,378**

(1) LPAH – low molecular weight polynuclear aromatic hydrocarbon
(2) HPAH – high molecular weight polynuclear aromatic hydrocarbon
Non-detections are represented as less than the quantitation limit.
(Exponent, 2003)

PCBs in sediment from the laterals and catch basin of the storm water conveyance system were found at levels that exceed the ERL and ERM of 22.7 μg/kg and 180 μg/kg, respectively (Long et al., 1995), as well as the proposed Alternative Sediment Cleanup Levels.

Sediment PCB levels, specifically Aroclor-1254 and 1260, and sediment PAH levels reported in the storm water conveyance system are also reported in the bay sediment near the storm water outfall as indicated by comparing Tables 4-4 and 4-5.

As outlined above, the City of San Diego MS4 Storm Drain SW4 has discharged pollutants, specifically Aroclor-1254 and 1260, and PAHs, into the BAE Systems leasehold and San Diego Bay at the Shipyard Sediment Site. These facts provide evidence that the City of San Diego MS4 Storm Drain SW4 has discharged and deposited pollutants to the Shipyard Sediment Site, both presently and in the past. As such, there exist NPDES violations of the requirements cited in Section 4.6.

4.7.3 City of San Diego, MS4 Storm Drain SW9 Violations

As described in Section 4.3.1, the City of San Diego owns and operates an MS4 storm drain identified as SW9 in the Shipyard Report (Exponent, 2003) (see Figure 4-2, above), which conveys urban runoff from source areas upgradient of NASSCO's property and discharges directly within the NASSCO leasehold. Urban runoff discharged into the SW9 storm drain outfall is subject to the NPDES requirements cited in Section 4.6. Although no monitoring data is available for this outfall, it is highly probable that historical and current discharges from this outfall have discharged heavy metals and organics to San Diego Bay at the Shipyard Sediment Site.[59]

A review of maps of the City's storm drain outfalls shows that the City's storm drain SW9 outfall is located in the NASSCO leasehold at the foot of 28th St. near the mouth of Chollas Creek (Exponent, 2003; ENV America, 2004a; City of San Diego, 2004a). SW9 collects flow from 28th Street, and stretches from the I-5 freeway to the bay including parts of Belt Street and Harbor Drive.

Surface sediment data at NASSCO sample station NA22, which is located near the SW9 storm drain outfall shows elevated concentrations of total high-molecular-weight polynuclear aromatic hydrocarbons (Total HPAHs) at 3600ug/kg), Dichlorodiphenyltrichloroethane (DDT) at 29.7μg/kg), and Chlordane at 21.1μg/kg. These pollutant levels are indicators of an urban runoff source (Exponent, 2003) and therefore indicate that historical urban runoff discharges occurred from the City via the SW9 outfall.

[59] See Section 4.3.2 for a description of the most common categories of pollutants found in urban runoff.

As described above, the surface sediment data at NASSCO sample station NA22 provides evidence that the City of San Diego MS4 Storm Drain SW9 conveys the HPAHs, DDT, and Chlordane pollutants into the NASSCO leasehold and San Diego Bay at the Shipyard Sediment Site. The urban runoff characteristics of the sediment pollutants at Station NA22 adjacent to the City of San Diego's MS4 Storm Drain SW9 provide evidence that the City has discharged pollutants to the Shipyard Sediment Site, both presently and in the past. The weight of evidence suggests that there are past and continuing discharges from Storm Drain SW9 that are contributing to the accumulation of pollutant in marine sediment to levels that violate the NPDES requirements cited in Section 4.6.

5. Finding 5: Marine Construction and Design Company and Campbell Industries, Inc.

~~Marine Construction and Design Company (MARCO) and Campbell Industries, Inc. (Campbell) are the parent companies to the operators of San Diego Marine Construction Corp (SDMC). SDMC operated a ship repair, alteration, and overhaul facility on what is now the Southwest Marine leasehold at the foot of Sampson Street in San Diego from approximately the 1920s to 1979. Shipyard operations were conducted at this site by SDMC over San Diego Bay waters or very close to the waterfront. An assortment of waste was generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. SDMC~~ Marine Construction and Design Company and Campbell Industries, Inc. (hereinafter collectively referred to as "SDMC") has (1) caused or permitted pollutants from its shipyard operations~~, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver,~~ and ~~zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls~~ terphenyls ~~(PCTs), polynuclear aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH)~~ to be discharged to San Diego Bay in violation of waste discharge requirements; and (2) discharged or deposited waste where it was discharged into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). ~~prescribed by the Regional Board. SDMC also deposited these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from SDMC's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay.~~ Based on these considerations, Marine Construction and Design Company and Campbell Industries, Inc. are referred to as "Discharger(s)" in this Cleanup and Abatement Order.

Between 1914 and 1979, San Diego Marine Construction Company and its successor San Diego Marine Construction Corporation, a wholly owned subsidiary of Campbell Industries, Inc., a wholly owned subsidiary of Marine Construction and Design Company (MARCO), collectively referred to as SDMC, operated a ship repair, alteration, and overhaul facility on what is now the BAE Systems leasehold at the foot of Sampson Street in San Diego. Shipyard operations were conducted at this site by SDMC over San Diego Bay waters or very close to the waterfront. An assortment of waste was generated at the facility including spent abrasive blast waste, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse.

5.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that Marine Construction and Design Company and Campbell Industries, Inc. should be named as dischargers in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

5.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;

6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

5.3 Marine Construction and Design Company (MARCO) and Campbell Industries, Inc. Owned the San Diego Marine Construction Facility

5.3.1 Leasehold Information

Marine Construction and Design Company (MARCO), through it's wholly owned subsidiary Campbell Industries, Inc. (Campbell) and Campbell through it's wholly owned subsidiary San Diego Marine Construction Corporation, previously known as San Diego Marine Construction Company, contributed to the accumulation of pollutants in marine sediment through waste discharges from its shipyard facility located within or adjacent to the current BAE Systems (formerly Southwest Marine) leasehold between 1914 and 1979 (Woodward-Clyde, 1995).

The City of San Diego granted a lease to SDMC at the foot of Sampson Street in 1914 (SDUPD, 2004). SDMC sold its leasehold to Marine Construction and Design Company (MCDC) in July 1972. MCDC was a wholly owned subsidiary of Campbell. MCDC changed its name to San Diego Marine Construction Corporation in August 1972. A leasehold summary states that Campbell was issued a lease for the site with an expiration date of November 30, 2018 (SDUPD, 2004). On August 31, 1979, Campbell surrendered its lease and leasehold to Southwest Marine. MARCO bought all the shares of Campbell in 1979. In October 1999, Campbell ceased all operations on San Diego Bay (SDUPD, 2004).

On February 19, 2004 the Regional Board issued Investigative Order R9-2004-0026 directing MARCO to submit a historical site assessment report that completely documented all leasehold information and activities in the vicinity of the current BAE Systems (formerly Southwest Marine) Shipyard leasehold that may have affected water quality, including chemical and waste handling and storage activities, discharges, and monitoring data.

By letter dated March 5, 2004, Mr. H. Allen Fernstrom of MARCO responded to the Regional Board's section 13267 Investigative Order and denied having any records of "operations within or adjacent to the current Southwest Marine leasehold from 1914-79, or any other time." Mr. Fernstrom also stated that they and the "…Campbell Industries subsidiary terminated all California operations in 1999…" Mr. Fernstrom's response letter, in its entirety, is provided below:

> *"Dear Mr. Robertus:*
> *Your investigation order to Marine Construction and Design Co. (MARCO) received on February 26, 2004 in connection with the Southwest Marine facility has been directed to my attention. MARCO has undertaken an internal search and has no information pertaining to, and has found no records of, any alleged MARCO and/or Campbell Industries operations within or adjacent to the current Southwest Marine leasehold from 1914-79, or any other time. MARCO has no California operations or offices. The Campbell Industries subsidiary terminated all California operations in 1999 at Eighth Avenue and Harbor Drive. The records we have from California-based operations pertain to the Campbell shipyards site at Eighth and Harbor and CAO95-21."*

MARCO was not responsive to the directives of the Regional Board's Investigative Order and their lack of responsiveness forms part of the basis for the Regional Board's determination that MARCO should be named as a discharger in the Cleanup and Abatement Order.[60]

Further investigation by the Regional Board into the ownership of San Diego Marine Construction found that:

- San Diego Marine Construction Corp., a California corporation, formerly known as San Diego Marine Construction Company, was the immediate predecessor tenant to Southwest Marine, Inc at the Shipyard Sediment Site, occupying the premises from July 14, 1972 until August 31, 1979. (See Appendix for Section 5, Tab A);
- San Diego Marine Construction Corp. was a wholly owned subsidiary of Campbell Industries, a California corporation and certain assets of San Diego Marine Construction Corp. were sold to Southwest Marine, Inc., as stated in a resolution adopted by the directors of Campbell Industries on July 27, 1979. (See Appendix for Section 5, Tab B);
- Southwest Marine, Inc. commenced occupation of the shipyard on September 1, 1979, immediately following San Diego Marine Construction Corp.'s surrender of it's leasehold interest to the Port District. (See Appendix for Section 5, Tab C); and

[60] See Resolution 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304,* as summarized in section 5.2 of this report. Refusal or failure to respond to Regional Board inquiries is one factor that the Regional Board must consider and use as a basis in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304.

- San Diego Marine Construction Corp was merged into Campbell on August 24, 1981 (Please see Appendix for Section 5, Tabs D & E) and Campbell Industries remains an active California corporation. (See Appendix for Section 5, Tabs F & G).

Based on these considerations, the Regional Board has determined that MARCO, through it's wholly owned subsidiary Campbell Industries, did have operations within the current BAE Systems (formerly Southwest Marine) leasehold from 1914 to 1979 and that MARCO, through it's wholly owned subsidiary Campbell Industries, has not terminated all California operations.

5.4 San Diego Marine Construction Corporation Owned and Operated a Full Service Ship Construction, Modification, Repair, and Maintenance Facility

5.4.1 Facility Description

The San Diego Marine Construction facility was a ship construction and repair facility located at the foot of Sampson Street in the City of San Diego. Ship repair facilities at San Diego Marine Construction included two floating drydocks and three marine railways, which together with cranes, enabled ships to be launched or repaired. The basic purpose of the drydocks was to separate the vessel from the bay to provide access to parts of the ship normally underwater. Piers were used to support berthed vessels undergoing maintenance and repair operations and berthing barges were used to house vessel crews while ship repairs were being conducted. Because drydock space was limited and expensive, many operations were conducted pier side. Marine railways were used to wheel vessels out of water (also called dry berthing a vessel). Activities conducted on dry berthed vessels were similar to those conducted in drydocks, but usually on a much smaller scale.

5.4.2 Activities Conducted by San Diego Marine Construction

Ship construction and repair have many industrial processes in common, including machining and metalworking, metal plating and surface finishing, surface preparation, solvent cleaning, application of paints and coatings, and welding. Although MARCO indicated that it had no records pertaining to SDMC activities, it is reasonable to assume that SDMC's industrial activities were typical for the ship construction and repair industry and involved a multitude of industrial processes, many of which were conducted over San Diego Bay waters or very close to the waterfront. SDMC's operations likely included the following industrial processes:

- **Surface Preparation and Paint Removal**. Methods of surface preparation and paint removal included dry abrasive blasting, wet abrasive or slurry blasting, hydroblasting, and chemical paint stripping;
- **Paint Application**. After preparation, surfaces were painted. Most painting occurred in a drydock and involved the ship hull and internal tanks. Painting was also conducted in other locations throughout the shipyard including piers and berths. Paint application was accomplished by way of air or airless spraying equipment and was a major activity at SDMC;
- **Tank Cleaning**. Tank cleaning operations used steam to remove dirt and sludge from internal tanks, particularly fuel tanks and bilges. Detergents, cleaners, and hot water were injected into the steam supply hoses;
- **Mechanical Repair/Maintenance/Installation**. A variety of mechanical systems and machinery required repair, maintenance, and installation;
- **Structural Repair/Alteration/Assembly**. Structural repair, alteration, and assembly generally involved welding, cutting, and fastening of steel plates or assembly blocks and other industrial processes;
- **Integrity/Hydrostatic Testing**. Hydrostatic or strength testing and flushing were conducted on hulls, tanks, or pipe repairs. Integrity testing was also conducted on new systems during ship construction phases;
- **Paint Equipment Cleaning**. All air and airless paint spraying equipment was typically cleaned following use. Paint equipment cleaning was a major producer of waste, including solvents, thinners, paint wastes, and sludges;
- **Engine Repair/Maintenance/Installation**. Automotive repair, ship engine repair, maintenance, and installation generated waste oils, solvents, fuels, batteries, and filters;
- **Steel Fabrication and Machining**. Fabrication of engine and ship parts occurred at SDMC. Cutting oils, fluids, and solvents were used extensively including acetone, methyl ethyl ketone (MEK) and chlorinated solvents;
- **Electrical Repair/Maintenance/Installation**. The repair, maintenance, and installation of electrical systems involved the use of numerous hazardous materials including trichlorethylene, trichloroethane, methylene chloride, and acetone;
- **Hydraulic Repair/Maintenance/Installation**. The repair, maintenance, and installation of hydraulic systems involved the replacement of spent hydraulic oils;
- **Tank Emptying**. Bilge, fuel, and ballast tanks were typically emptied prior to ship repair activities;
- **Fueling**. Fueling operations occurred at SDMC;
- **Shipfitting**. Shipfitting was conducted at SDMC, and is defined as the forming of ship plates and shapes, etc. according to plans, patterns, or molds;

- **Carpentry**. Woodworking, with associated wood dust production, was conducted at SDMC; and
- **Refurbishing/Modernization/Cleaning**. Refurbishing, modernization, and cleaning of ships were conducted at SDMC.

5.4.3 Materials Used by San Diego Marine Construction

Materials that were commonly used for the above listed industrial shipyard activities are summarized below. Although a few specific materials are included, the list consists primarily of major categories.

- **Abrasive Grit**. Typically slag was collected from coal-fired boilers and consisted principally of iron, aluminum, silicon, and calcium oxides. Trace elements such as copper, zinc and titanium were also likely present. Sand, cast iron, or steel shot were also used as abrasives. Enormous amounts of abrasive were needed to remove paint; for example, removing paint from a 15,000 square foot hull could take up to 6 days and consume 87 tons of grit. Grit was needed in all dry and wet abrasive blasting.
- **Paint**. Paints contained copper, zinc, chromium, and lead as well as hydrocarbons. Two major types of paints used on ship hulls were:
    - Anticorrosive Paints (primers) Vinyl, vinyl-lead, or epoxy based coatings are used. Others contained zinc chromate and lead oxide.
    - Antifouling Paints were used to prevent growth and attachment of marine organisms by continuously releasing toxic substances into the water. Cuprous oxide and tributyltin fluoride or tributyltin oxide were the principal toxicants in copper-based and organotin-based paints, respectively.
- **Miscellaneous Materials**. Oils (engine, cutting, and hydraulic), lubricants, grease, fuels, weld, detergents, cleaners, rust inhibitors, paint thinners, hydrocarbon and chlorinated solvents, degreasers, acids, caustics, resins, adhesives/cement/sealants, and chlorine.

5.4.4 Waste Generated by San Diego Marine Construction

Categories of wastes commonly generated by the above listed industrial shipyard activities include, but are not limited to, those listed below.

- **Abrasive Blast Water**. Spent Grit, Spent Paint, Marine Organisms, and Rust. Abrasive blast waste, consisting of spent grit, spent paint, marine organisms, and rust was generated in significant quantities during all dry or wet abrasive blasting procedures. The constituent of greatest concern with regard to toxicity is the spent paint, particularly the copper and tributyltin antifouling components, which are designed to be toxic and to continuously leach into the water. Other pollutants in paint included zinc, chromium, and lead. Abrasive blast waste was conveyed by water flows, by becoming airborne (especially during dry blasting), or by falling directly into receiving waters;

- **Fresh Paint**. Losses occurred when paint ended up somewhere other than its intended location (e.g., drydock floor, bay, worker's clothing). These losses resulted from spills, drips, and overspray. Typical overspray losses are estimated to have been approximately 5 percent for air spraying; and 1 to 2 percent for airless spraying;
- **Bilge Waste/Other Oily Wastewater**. This waste was generated during tank emptying, leaks, and cleaning operations (bilge, ballast, fuel tanks). In addition to petroleum products (fuel, oil), tank washwater also contained detergents or cleaners and was generated in large quantities;
- **Blast Wastewater**. Hydroblasting generated large quantities of wastewater. In addition to suspended and settleable solids (spent abrasive, paint, rust, marine organisms) and water, blast wastewater also may have contained rust inhibitors such as diammonium phosphate and sodium nitrite;
- **Oils (engine, cutting, and hydraulic)**. In addition to spent products, fresh oils, lubricants, and fuels were released as a result of spills and leaks from ship or drydock equipment, machinery, and tanks (especially during cleaning and refueling);
- **Waste Paints/Sludges/Solvents/Thinners**. These wastes were generated from cleaning paint equipment;
- **Construction/Repair Wastes and Trash**. These wastes included scrap metal, welding rods, slag (from arc welding), wood, rags, plastics, cans, paper, bottles, packaging materials, etc.; and
- **Miscellaneous Wastes**. These wastes included lubricants, grease, fuels, sewage (black and gray water from vessels or docks), boiler blowdown, condensate, discard, acid wastes, caustic wastes, aqueous wastes (with and without metals).

The SDMC facility was located immediately adjacent to San Diego Bay. Surface water runoff from the facility, unless diverted, directly entered the bay. Wastes from the facility were conveyed to the bay by water flows, becoming airborne (especially during painting and blasting operations), or falling directly into the bay.

5.5 San Diego Marine Construction Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirements

SDMC has caused or permitted pollutants from its shipyard operations to be discharged to San Diego Bay in violation of waste discharge requirements. Based on the information provided in Sections 5.4, 5.9, and 5.10 the wastes likely contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH.

SDMC's waste discharges were regulated pursuant to Clean Water Act section 402 and Water Code section 13376. SDMC was to comply with all conditions of the NPDES Permit requirements. These requirements are referred to as either NPDES requirements or by the federal terminology "NPDES Permit." Any noncompliance of NPDES Permit requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304. Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides, in relevant part, that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement…"

SDMC's NPDES discharges were regulated by Order No. 74-84, NPDES No. CA0107697 Waste Discharge Requirements for San Diego Marine Construction Corp. Details are provided in Section 5.8 of this Technical Report. SDMC's discharges of waste in violation of Order No. 74-84 are discussed in the following paragraphs.

B. Provision 1 of Order No. 74-84 directs that "neither the treatment nor the discharge of pollutants shall create a pollution, contamination or nuisance." Additionally, B. Provision 6 incorporates by reference Standard Provision 10 that prohibits any discharge of harmful quantities of oil or hazardous substances.

B. Provision 2 of Order No. 74-84 directed SDMC to prepare and submit a *"Water Pollution Control Plan"* describing how SDMC would control the discharge of pollutants including "…trash, scale, rust, old paint, marine growths, new paint, oil and grease, sewage, wash water, and cooling water…." from each marine railway, floating dry dock, and work area. B. Provision 2 provides that, upon approval by the Regional Board Executive Officer and the U.S. EPA Regional Administrator, the *"Water Pollution Control Plan"* would become an enforceable condition of Order No. 74-84. B. Provision 3 of Order No. 74-84 further provided that SDMC prepare and submit the *"Water Pollution Control Plan"* by February 1, 1975 and complete implementation of the plan by June 1, 1975.

SDMC subsequently requested an extension of the *"Water Pollution Control Plan"* implementation date and the Regional Board adopted Addendum No. 1 to Order No. 74-84 in June of 1975, extending the implementation date to October 1, 1975. Regional Board file records indicate that there were continued delays by SDMC in implementing the *"Water Pollution Control Plan"* by constructing concrete dams for trapping pollutants and that the plan had still not been fully implemented by SDMC as of December 1976[61]. It is concluded that incidents of excessive discharges of pollutants from SDMC to San Diego Bay from the SDMC facility occurred throughout this period.

5.6 San Diego Marine Construction Discharged Waste to San Diego Bay Creating a Condition of Pollution, Contamination, and Nuisance Conditions in San Diego Bay

Based on the information regarding the leasehold history and historical activities provided in sections 5.3, 5.4, 5.7, 5.8, 5.9, and 5.10 the Regional Board has determined that Marine Construction and Design Company, and it's wholly owned subsidiary Campbell Industries, Inc., through it's wholly owned subsidiary San Diego Marine Construction Corporation, previously known as San Diego Marine Construction Company, are responsible for discharging pollutants to the Shipyard Sediment Site as a result of their shipyard operations on what is currently the BAE Systems leasehold. Water Code section 13304 requires that a person who causes any waste to be discharged, or deposited where it probably will be discharged, into waters of the state creating, or threatening to create, a condition of pollution or nuisance is subject to cleaning up or abating the effects of the waste.

The Porter-Cologne Water Quality Act defines "pollution" as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects… …the waters for beneficial uses …"[62] "Contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected."[63]

The discharge of pollutants included heavy metals and organics, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, butyl tin species, PCBs, PCTs, PAHs, and TPH. As described in other sections of this report, these same pollutants have accumulated in San Diego Bay sediment adjacent to the former SDMC facility in concentrations that adversely affect the beneficial uses of San Diego Bay and present a public health risk.

[61] See Regional Board letters to Mr. Gary Higgins, Operations Manager, SDMC, dated November 23, 1976 and December 29, 1976 on SDMC's delays in implementing the Water Pollution Control Plan (RWQCB, 1976a; RWQCB, 1976b).
[62] Water Code section 13050(1).
[63] Water Code section 13050(k).

Accordingly, it is concluded that Marine Construction and Design Company, and it's wholly owned subsidiary Campbell Industries, Inc., through it's wholly owned subsidiary San Diego Marine Construction Corporation, previously known as San Diego Marine Construction Company, have caused or permitted waste to be discharged or deposited where it was discharged to San Diego Bay in a manner causing the creation of pollution, contamination, or nuisance conditions, and that it is appropriate for the Regional Board to issue a cleanup and abatement order naming the Marine Construction and Design Company and Campbell Industries, Inc. as dischargers pursuant to Water Code section 13304.

Further discussion on pollution, contamination, and nuisance are available in Sections 1.4 and 1.5 of this Technical Report.

5.7 1972 Regional Board Ship Building and Repair Yard Investigation

In March of 1972, the Regional Board initiated an investigation to determine the amount and kinds of pollutants that entered San Diego Bay from shipbuilding and repair facilities, and the possible effects that the pollutants could have on beneficial uses of San Diego Bay.[64] All shipbuilding and repair facilities located on San Diego Bay were inspected, including SDMC. Interviews with owners and managers of the facilities were conducted to determine (for the year 1971) the number of ships built or refinished at each facility; the cleaning methods employed; the amounts and kinds of vessel hull paints used; and the methods of disposing of trash, sandblasting waste, paints and oils. Bay sediment core samples were collected from San Diego Bay at various locations including the SDMC leasehold. The report contains the following information pertaining to SDMC discharges:

- SDMC was engaged in shipbuilding and repair activities during 1971. Facilities included two dry docks (360 foot and 220 foot capacity respectively) and three marine railways (100 foot vessel capacity);
- During 1971, SDMC constructed six new ships and refinished 70 ships up to 390 feet in length. Approximately 80 percent of the vessels were constructed of steel, 15 percent from wood and 5 percent from fiberglass. Approximately 20 to 50 percent of these ships were sand blasted. Approximately 8,000 gallons of paint and primer containing copper and tributyltin were used. Air sand blasting with black sand was used to strip vessels to bare metal in the dry docks and on marine railways;

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64 The results of this investigation are contained in California Regional Water Quality Control Board, San Diego Region, Wastes Associated with Shipbuilding and Repair Facilities in San Diego Bay, June 1972 (RWQCB, 1972).

- The SDMC facility was located immediately adjacent to San Diego Bay. Wastes from the facility were conveyed to the bay by water flows, by becoming airborne (especially during painting and blasting operations), or by falling directly into the bay;
- It was estimated by workers and managers at all San Diego Bay shipyards that 5 to 10 percent of the sand blasted waste and other waste was discharged to San Diego Bay. Based on Regional Board waste volume estimates, this resulted in 335 tons of sand, 27 tons of copper oxide, 3 tons of lead oxide and 1 ton of zinc chromate being discharged to San Diego Bay on an annual basis in 1971; and
- On March 7, 1972 the Regional Board collected bay sediment core samples from 11 selected sites in San Diego Bay offshore of the ship building and repair facilities (RWQCB, 1972). The results of the core sampling indicated that heavy metal concentrations in bay sediment were higher near the ship building and repair facilities than at other locations of San Diego Bay. Sampling Station No. 1 was located at SDMC dry dock 1 and was included in the group of five stations that had the highest total concentration of metals (arsenic, chromium, copper, lead, mercury, nickel, and zinc).

5.8 NPDES Requirement Regulation

Waste discharges from the SDMC facility was regulated under Waste Discharge Requirements (WDRs) prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. These requirements are referred to as either NPDES requirements[65] or by the federal terminology "NPDES Permit." SDMC's NPDES requirements started in 1974, when the Regional Board issued WDRs to regulate specific shipyard activities.

On or about July 16, 1974 SDMC submitted an NPDES Permit application to the Regional Board for the discharge of pollutants to San Diego Bay from its facility at the foot of Sampson Street in the City of San Diego. The discharges to San Diego Bay subject to NPDES requirement regulation reported by SDMC included "...fouling organisms, paint, sandblasting sand and debris, oil, fuel , trash, cooling water, sewage…"[66] On November 4, 1974 the Regional Board adopted Order No. 74-84, NPDES Permit No. CA0107697, *Waste Discharge Requirements for San Diego Marine*

[65] Pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Act, to avoid the issuance by the United States Environmental Protection Agency of separate and duplicative NPDES permits for discharges in California that would be subject to the Clean Water Act, the State's Waste Discharge Requirements (WDRs) for such discharges implement the NPDES regulations and entail enforcement provisions that reflect the penalties imposed by the Clean Water Act for violation of NPDES permits issued by the U.S. EPA. Thus, the State's WDRs that implement federal NPDES regulations (NPDES requirements) serve in lieu of NPDES permits.

[66] See Finding 5 of Order No. 74-84, NPDES Permit No. CA0107697, Waste Discharge Requirements for San Diego Marine Construction Corporation adopted by the Regional Board on November 4, 1974.

Construction Corporation. Order No. 74-84 remained in effect for SDMC until August 31, 1979, when the facility was sold to Southwest Marine (now BAE Systems).

5.8.1 Order No. 74-84, NPDES Permit No. CA0107697

Order No. 74-84, NPDES Permit No. CA0107697 was in effect from November 4, 1974 to August 31, 1979, and contained the following finding and requirements that relate to the discussions contained herein:

- FINDING 5. During construction, repair, and cleaning operations, some pollutants, such as fouling organisms, paint, sandblasting sand and debris, oil, fuel, trash, cooling water, sewage, etc. are discharged or washed into San Diego Bay. Runoff of precipitation falling within the work yard, marine railways and floating drydocks also washes pollutants to San Diego Bay.
- B. PROVISIONS … 1. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination or nuisance as defined in the California Water Code.
- B. PROVISIONS … 2. The discharger shall develop and implement a Water Pollution Control Plan, acceptable to the Executive Officer, detailing means of controlling the discharge of pollutants from each marine railway, floating drydock and work area. The plan must address all of the following waste source categories that are generated at each facility and detail specific methods by which pollution from these sources will be controlled: trash, scale, rust, old paint, marine growths, new paint, oil and grease, sewage, wash water and cooling water. In developing the plan, the Discharger should consider methods of segregating the wastes listed above to prevent contact with precipitation and other liquids discharged to San Diego Bay, as well as methods of maintaining working areas in "broom clean" or equivalent conditions. Upon approval by the Executive Officer and the Regional Administrator, the Water Pollution Control Plan developed by the discharger shall become a condition of this permit.
- B. PROVISIONS … 3. The discharger shall comply with t he following time schedule to assure compliance with Provision B.2 of this order:

Task	Completion Date	Report of Compliance Due
Develop Water Pollution Control Plan and submit plan to the Executive Officer	2-1-75	--
Begin implementation of approved Water Pollution Control Plan	5-1-75	5-15-75
Complete implementation of approved Water Pollution Control Plan	6-1-75	6-15-75

- B. PROVISIONS … 6. This order includes Items 1, 2, 4, 5, 6, 7, 8, 9 and 10 of the attached “Standard Provisions.”

  Standard Provisions … 1. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under federal, state, or local laws, nor guarantee the discharger a capacity right in the receiving waters. … 2. The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited. … 4. The discharger shall permit the Regional Board: (a) Entry upon premises in which an effluent source is located or in which any required records are kept; (b) access to copy any records required to be kept under terms and conditions of this order; (c) inspections of monitoring equipment or records, and (d) sampling of any discharge. … 5. All discharges authorized by this order shall be consistent with the terms and conditions of this order. The discharge of any pollutant more frequently than or at a level in excess of that identified and authorized by this order shall constitute a violation of the terms and conditions of this order. … 6. The discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with the waste discharge requirements. … 7. Collected screenings, sludges, and other solids removed from liquid wastes shall be disposed of at a legal point of disposal, and in accordance with the provisions of Division 7.5 of the California Water Code. For that purpose of this requirement, a legal point of disposal is defined as one for which waste discharge requirements have been prescribed by a Regional Water Quality Control Board and which is in full compliance therewith. … 8. After notice and opportunity for a hearing, this order may be terminated or modified for cause, including, but not limited to: (a) violation of any term or condition contained in this order; (b) obtaining this order by misrepresentation, or failure to disclose fully all relevant facts; (c) a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge. … 9. If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under section 307(a) of the Federal Water Pollution Control Act, or amendments thereto, for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this order, the Board will revise or modify this order in accordance with such toxic effluent standard or prohibition and so notify the discharger. … 10. There shall be no discharge of harmful quantities of oil or hazardous substances, as specified by regulation adopted pursuant to section 311 of the Federal Water Pollution Control Act, or amendments thereto.

5.9 Industry-wide Historical Operational Practices

In November of 1997, the U.S. EPA released a study titled “EPA Office of Compliance Sector Notebook Project: PROFILE OF SHIPBUILDING AND REPAIR INDUSTRY.” According to the 1995 Toxic Release Inventory (TRI) data, the reporting shipbuilding and repair facilities released and transferred 39 different TRI chemicals for a total of approximately 6.5 million pounds of pollutants during calendar year 1995. These releases and transfers were dominated by volatile organic compounds (VOCs) and metal-bearing wastes, approximately 52 percent and 48 percent, respectively (U.S. EPA, 1997c).

Releases to the air, water, and land have accounted for 37 percent (2.4 million pounds) of the shipyard’s total reportable chemicals. Of these releases, over 98 percent were released to the air from fugitive (74.6 percent; 1,778,818 pounds) or point (24.1 percent; 574,097 pounds) sources, while approximately 1.2 percent (29,479 pounds) were release directly to water (U.S. EPA, 1997c). However, a significant percentage of the total pollutants released as fugitive air or point air releases end up in the water, adding significantly to the 1.2 percent that is released directly to water.

VOCs accounted for about 86 percent of the shipyard’s reported TRI releases. Xylenes, n-butyl alcohol, toluene, methyl ethyl ketone, and methyl isobutyl ketone account for about 65 percent of the industry’s reported releases. These organic compounds are typically found in solvents that were used extensively by the industry in thinning paints and for cleaning and degreasing metal parts and equipment (U.S. EPA, 1997c).

The remainder of the releases were primarily metal-bearing wastes. Copper, zinc, and nickel-bearing wastes accounted for about 14 percent of the industry’s reported releases. These pollutants were released primarily as fugitive emissions during metal plating operations and as overspray in painting operations and could also have been released as fugitive dust emissions during blasting operations (U.S. EPA, 1997c).

5.9.1 Miscellaneous Information on SDMC Discharges

Historical operations at SDMC during the years from 1914 to the late 1970’s included the following (SDUPD, 2004):

- Used formaldehyde and arsenic in pretreated wood at the woodshop;
- Performed blasting, welding, and painting activities for Navy contract work in the blasting area;
- Used a dust suppression system for the blasting house, which consisted of blowers directed at the bay with a water spray to cause the blast dust to settle in the water; and
- Discharged all wastes generated on the dry dock, including blast grit, paint, etc. into the bay.

The shipyard operations that generate wastes including heavy metals and organic chemicals at SDMC included the following (SDUPD, 2004):

- Surface preparation and paint removal;
- Paint application;
- Tank cleaning; and
- Mechanical repair/maintenance/installation.

Delta Lines submitted a complaint to the San Diego Unified Port District in 1970 regarding sandblasting residue from SDMC (SDUPD, 2004). In 1973, an undetermined amount of fuel was released into San Diego Bay from SDMC, resulting in temporary closure of the site (SDUPD, 2004).

5.10 Sediment Core Analytical Results

The sediment core analytical results were evaluated to assess the potential presence of wastes released by SDMC. The Shipyard Report provides analytical results from sediment cores collected down to depths of approximately 6 to 8 feet (Exponent, 2003). The results from Stations SW04, SW08, SW17, and SW28, the core locations closest to the shoreline within the former SDMC leasehold, are discussed below.

Peng et. al. (2003) reports a sedimentation rate of 0.92 centimeters per year (cm/yr) at a sampling station in the vicinity of the Shipyard Sediment Site outside the former SDMC leasehold. The sedimentation rate may be higher within the leasehold closer to the shoreline since the currents may be less and the shoreline is nearer the source(s) of sediment input. Table 5-1 shows the estimated years associated with the core depths for two different sedimentation rates. A sedimentation rate of 0.92 cm/yr suggests that the sediment in the 2 to 4 foot core were deposited prior to approximately 1936. Assuming a higher sedimentation rate of 2 cm/yr indicates that the sediment in the 2 to 4 foot core were deposited from approximately 1972 to 1942.

Table 5-1. Deposition Years for Cores Based on Sedimentation Rates

Core Depth	0.92 cm/year[1]	2.0 cm/year[2]
0 to 2 feet	2002 to 1936	2002 to 1972
2 to 4 feet	1936 to 1870	1972 to 1942
4 to 6 feet	1870 to 1804	1942 to 1912

[1] 0.92 cm/year corresponds to approximately 33 years per foot.
[2] 2 cm/year corresponds to approximately 15 years per foot.

The analytical results from Stations SW04, SW08, SW17, and SW28, the core locations closest to the shoreline within the former SDMC leasehold, are provided in Table 5-2 below. The analytical results for tributyltin (TBT) were used to evaluate the applicability of the two deposition rates in Table 5-1. TBT was first used as a marine antifouling coating in the 1960s (GlobalSecurity.org, 2005). Therefore TBT should not be reported in sediment deposited prior to the 1960s unless TBT in the overlying sediment contaminated the underlying sediment by mechanisms such as bioturbation or disturbances via propeller wash.

Review of the 2 to 4 foot core results presented in Table 5-2 indicates the presence of significant TBT levels. A deposition rate of 0.92 cm/yr, suggests that the sediment at 2 to 4 feet were deposited between 1936 and 1870. However the TBT concentrations suggest that the 2 to 4 foot core interval includes sediment from the late 1960s or early 1970s. Therefore it is judged that the sedimentation rate is higher than 0.92 cm/year. A deposition rate of 2 cm/year suggests that the sediment in the core from 2 to 4 feet were deposited from 1942 to 1972. These dates are consistent with presence of TBT in cores collected at those depths. Therefore, the higher deposition rate of 2 cm/year is judged to be more applicable to the Shipyard Sediment Site than the lower 0.92 cm/yr rate.

Based on this evaluation it is concluded that the pollutants in the 2 to 4 foot cores include discharges made during the time of SDMC tenancy from 1914 to 1979. As indicated in Table 5-2, some of the highest concentrations for PCBs, benzo[a] pyrene, tributyltin, arsenic, cadmium, chromium, copper, mercury, and nickel within each core are from the 2 to 4 feet depth.

Table 5-2. Selected Results from Core Stations SW04, SW08, SW17, and SW28

Depth	Contaminant	SW04	SW08	SW17	SW28
0 to 0.06 feet	PCB homologs µg/kg	5,200	2,700	-	2,600
0 to 2 feet	PCB homologs µg/kg	1,300	10,000	1,100	3,200
2 to 4 feet	PCB homologs µg/kg	27,000	13,000	1,300	1,200
4 to 5 feet	PCB homologs µg/kg				61
4 to 6 feet	PCB homologs µg/kg		490	420	
6 to 6.5 feet	PCB homologs µg/kg		6.2		
Sediment Cleanup Level[1] for PCBs is 420 µg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Benzo [a] pyrene µg/kg	2,100	3,300	-	2,000
0 to 2 feet	Benzo [a] pyrene µg/kg	1,100	2,600	1,600	4,000
2 to 4 feet	Benzo [a] pyrene µg/kg	5,800	3,000	620	1,500
4 to 5 feet	Benzo [a] pyrene µg/kg				250
4 to 6 feet	Benzo [a] pyrene µg/kg		85	200	
6 to 6.5 feet	Benzo [a] pyrene µg/kg		6		
Sediment Cleanup Level[1] for BAP is 1,100 µg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Tributyltin µg/kg	3,300	1,900	-	150
0 to 2 feet	Tributyltin µg/kg	1,900	7,000	920	220
2 to 4 feet	Tributyltin µg/kg	5,000	5,100	600	8.2
4 to 5 feet	Tributyltin µg/kg				0.85
4 to 6 feet	Tributyltin µg/kg		44	57	
6 to 6.5 feet	Tributyltin µg/kg		2.3		
Sediment Cleanup Level[1] for tributyltin is 110 µg/kg					

[1] See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

Table 5-2. Selected Results from Core Stations SW04, SW08, SW17, and SW28 Continued

Depth	Contaminant	SW04	SW08	SW17	SW28
0 to 0.06 feet	Arsenic mg/kg	73	24	-	14
0 to 2 feet	Arsenic mg/kg	68	24	15	15
2 to 4 feet	Arsenic mg/kg	110	13	15	6.6
4 to 5 feet	Arsenic mg/kg				7
4 to 6 feet	Arsenic mg/kg		4.9	3.7	
6 to 6.5 feet	Arsenic mg/kg		2.1		
Sediment Cleanup Level[1] for arsenic is 10 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Cadmium mg/kg	1.9	0.73	-	0.31
0 to 2 feet	Cadmium mg/kg	0.79	1.1	0.68	2.7
2 to 4 feet	Cadmium mg/kg	3.2	0.86	1.4	2.3
4 to 5 feet	Cadmium mg/kg				1.2
4 to 6 feet	Cadmium mg/kg		0.07	.44	
6 to 6.5 feet	Cadmium mg/kg		0.03		
Sediment Cleanup Level[1] for cadmium is 1.0 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Chromium mg/kg	80	83	-	65
0 to 2 feet	Chromium mg/kg	26	100	87	76
2 to 4 feet	Chromium mg/kg	97	110	54	67
4 to 5 feet	Chromium mg/kg				41
4 to 6 feet	Chromium mg/kg		7.4	30	
6 to 6.5 feet	Chromium mg/kg		3.7		
Sediment Cleanup Level[1] for chromium is 81 mg/kg					

See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

Table 5-2. Selected Results from Core Stations SW04, SW08, SW17, and SW28 Continued

Depth	Contaminant	SW04	SW08	SW17	SW28
0 to 0.06 feet	Copper mg/kg	1,500	900	-	270
0 to 2 feet	Copper mg/kg	370	1,500	440	280
2 to 4 feet	Copper mg/kg	2,200	1,500	280	100
4 to 5 feet	Copper mg/kg				50
4 to 6 feet	Copper mg/kg		49	530	
6 to 6.5 feet	Copper mg/kg		4.2		
Sediment Cleanup Level[1] for copper is 200 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Lead mg/kg	430	220	-	100
0 to 2 feet	Lead mg/kg	150	360	100	170
2 to 4 feet	Lead mg/kg	410	340	90	67
4 to 5 feet	Lead mg/kg				46
4 to 6 feet	Lead mg/kg		11	23	
6 to 6.5 feet	Lead mg/kg		1.8		
Sediment Cleanup Level[1] for lead is 90 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Mercury mg/kg	1.7	2.3	-	0.88
0 to 2 feet	Mercury mg/kg	1.1	4.8	1.30	1.5
2 to 4 feet	Mercury mg/kg	7.4	6.0	0.67	2.5
4 to 5 feet	Mercury mg/kg				1.4
4 to 6 feet	Mercury mg/kg		0.3	0.17	
6 to 6.5 feet	Mercury mg/kg		0.005		
Sediment Cleanup Level[1] for mercury is 0.7 mg/kg					

See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

Table 5-2. Selected Results from Core Stations SW04, SW08, SW17, and SW28 Continued

Depth	Contaminant	SW04	SW08	SW17	SW28
0 to 0.06 feet	Nickel mg/kg	18	21	-	15
0 to 2 feet	Nickel mg/kg	8.3	15	19	23
2 to 4 feet	Nickel mg/kg	40	9.1	12	19
4 to 5 feet	Nickel mg/kg				13
4 to 6 feet	Nickel mg/kg		2.6	7.6	
6 to 6.5 feet	Nickel mg/kg		1.5		
Sediment Cleanup Level[1] for nickel is 20 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Silver mg/kg	1.6	1.5	-	1.1
0 to 2 feet	Silver mg/kg	0.59	1	2.0	2.8
2 to 4 feet	Silver mg/kg	1.4	0.49	1.1	2.2
4 to 5 feet	Silver mg/kg				0.9
4 to 6 feet	Silver mg/kg		0.03	0.29	
6 to 6.5 feet	Silver mg/kg		0.01		
Sediment Cleanup Level[1] for silver is 1.5 mg/kg					
Depth	**Contaminant**	**SW04**	**SW08**	**SW17**	**SW28**
0 to 0.06 feet	Zinc mg/kg	3400	830	-	330
0 to 2 feet	Zinc mg/kg	670	1,300	500	530
2 to 4 feet	Zinc mg/kg	1,500	790	400	280
4 to 5 feet	Zinc mg/kg				160
4 to 6 feet	Zinc mg/kg		34	130	
6 to 6.5 feet	Zinc mg/kg		10		
Sediment Cleanup Level[1] for zinc is 300 mg/kg					

[1] See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

There are uncertainties associated with this analysis. The estimated age associated with the core depths is dependent upon the sedimentation rate. However, unless the actual sedimentation rate is significantly higher than the 0.92 cm/yr to 2 cm/yr rates discussed above, it is likely that the sediment below 2 feet were deposited before 1979, which was the end of SDMC's occupancy of the leasehold. Physical disturbances, such as bioturbation, dredging, and propeller wash, also introduce uncertainty into this interpretation. For example, if propeller wash from ship movements removes material from the bottom, the shallow sediment may be older than that indicated by applying the sedimentation rate. If disturbances result in redeposition of older sediment on top of newer sediment, the shallow sediment may be older than interpreted.

The Shipyard Report uses the presence of graded bedding in the sediment profiles to identify areas of no apparent physical disturbance. Stations SW08 and SW17 were reported to be stations with no apparent physical disturbance (Exponent, 2003). Therefore, assuming a deposition rate of 2 cm/yr or less, the pollutants reported in the sediment below 2 feet at Stations SW08 and SW17 include discharges prior to 1972 and include wastes discharged by SDMC during their tenancy from 1914 to 1972.

6. Finding 6: Chevron, A Subsidiary of ChevronTexaco

Chevron, a subsidiary of ChevronTexaco , owns and operates the Chevron Terminal, a bulk fuel storage facility currently located at 2351 East Harbor Drive in the City of San Diego adjacent to the NASSCO and BAE Systems leaseholds. Fuel products containing petroleum hydrocarbons and related constituents such as polynuclear aromatic hydrocarbons (PAHs) have been stored at the Chevron Terminal since the early 1900s at both the currently operating 7 million gallon product capacity upper tank farm and the closed 5 million gallon capacity lower tank farm. Storm water flows from Chevron Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Industry-wide operational practices, especially in the years prior to the State of California's passage of the Aboveground Petroleum Storage Act in 1990, often led to discharges from aboveground storage tank facilities such as the Chevron Terminal as a result of leaks and spills from tanks due to advanced age, defects in design or installation, human error, and equipment failure. Available records provide evidence of specific discharges of petroleum hydrocarbon pollutants from the Chevron Terminal facility to San Diego Bay at the Shipyard Sediment Site as a result of various spills and leaks in 1913, 1967 and 1973. Elevated concentrations of phase separated hydrocarbons (PSH) pollutants have also been found in soil and ground water at the upper and the former lower tank farm site. These pollutants may eventually migrate to San Diego Bay at the Shipyard Sediment Site via various preferential pathways. Chevron also discharges storm water runoff from Chevron Terminal to San Diego Bay at the Shipyard Sediment Site subject to the terms and conditions of the statewide Industrial NPDES Storm Water Permit. Monitoring reports submitted by Chevron during the years 1994 through 2004 indicate elevated levels of zinc; lead, cadmium, and copper are consistently present in the storm water discharge from the site. Based on these considerations Chevron caused or permitted the discharges of petroleum hydrocarbons, PAHs, zinc, lead, cadmium, and copper into San Diego Bay at the Shipyard Sediment Site, in violation of waste discharge requirements prescribed by the Regional Board. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on the information that the Regional Board has reviewed to date, there is insufficient evidence to find that discharges from the Chevron Terminal contributed to the accumulation of pollutants in the marine sediment at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance. Accordingly, Chevron is not referred to as "Discharger(s)" in this Cleanup and Abatement Order.

6.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that Chevron, a subsidiary of ChevronTexaco, should not be named as a discharger in Cleanup and Abatement Order No. R9-2005-0126 because there is insufficient evidence to find that discharges from the Chevron Terminal contributed to the accumulation of pollutants in the marine sediment at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance.

6.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;

5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

6.3 Chevron, A Subsidiary of ChevronTexaco

Chevron companies (including Standard Oil Company and Chevron Products Company) have operated bulk fuel storage terminal #100-1252 (Chevron Terminal) since the early 1900s. The Chevron Terminal current address is 2351 East Harbor Drive in the City of San Diego. Fuel products containing petroleum hydrocarbons have been stored at Chevron Terminal at both the currently operating 7 million gallon product capacity upper tank farm and the closed 5 million gallon capacity lower tank farm and relocated lower tank farm. In addition to the tank farms, the Chevron Facilities formerly included a fueling pier, wharf, petroleum warehouse, and associated pipelines. Details regarding current and historical activities are provided in Section 6.4 below.

Chevron submitted a Technical Data Report (LFR Report) and the report "Evaluation of Polynuclear Aromatic Hydrocarbons and Metals in the San Diego Shipyard Site Sediments" (List Report) in response to Regional Board Investigation Orders No. R9-2004-0026 and R9-2004-0027 (LFR Levine-Fricke, 2004; List, 2005). The LFR Report provides information regarding current and historical activities associated with the Chevron Terminal. The List Report evaluates the PAHs and metals in the sediment to identify likely sources. The List Report is discussed below in Section 6.9 Analyses and Evaluations of Petroleum Hydrocarbons.

6.4 Current and Historical Activities

Chevron's operations have involved the transport, handling, and use of a wide variety of chemicals including premium unleaded gasoline, mid-grade unleaded gasoline, regular unleaded gasoline, product contact water, transmix, generic additive, techron additive, diesel fuel, ethanol, jet fuel, solvent, household cleaning products, motor oil, engine coolant, paint, thinner, lube oil, stove oil, Stoddard solvent, aviation gasoline, pearl oil, distillate oil, and black oil (SDUPD, 2004).

Chevron formerly operated bulk fuel storage and transfer operations at locations on the current NASSCO property and adjacent to the BAE Systems property (LFR Levine-Fricke, 2004). The relocated lower tank farm was adjacent to the BAE Systems leasehold and approximately 100 feet from San Diego Bay. According to information provided by Chevron, their former operations on the NASSCO property included a fueling pier (National Steel Marine Terminal Pier 1) in San Diego Bay, the former relocated tank farm, and associated pipelines from the fueling pier to the tank farm (LFR Levine-Fricke, 2004). Chevron leased a portion of the area between the Chevron Terminal and San Diego Bay for operation of the fueling pier and pipeline connecting the pier to the current and former tank farms from approximately 1920 to 1974. The Chevron Report refers to this as the wharf lease.

Storm water flows from the Chevron Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Petroleum hydrocarbons from tanks and/or piping releases have been found in soil and ground water at the upper and the former lower tank farms. The regional groundwater gradient is generally towards San Diego Bay. Over 30 groundwater monitoring wells have been installed by Chevron to investigate the impacts to groundwater in the vicinity of their current and former tank farms. The monitoring results indicate that the groundwater contamination does not extend to San Diego Bay (LFR Levine-Fricke, 2004).

6.5 NPDES Requirement Regulation

Waste discharges from the Chevron Terminals facility have been regulated since 1974 under Waste Discharge Requirements (WDRs) prescribed by the Regional Board pursuant to Clean Water Act Section 402 and Water Code section 13376. These requirements are referred to as either NPDES requirements or by the federal terminology "NPDES Permit". Chevron currently discharges storm water runoff from Chevron Terminal to San Diego Bay at the Shipyard Sediment Site subject under the terms and conditions of the statewide Industrial NPDES Storm Water Permit. The Regional Board conducted a file review and determined that no significant NPDES requirement violations occurred at the Chevron Terminal facility during the period when it was subject to NPDES requirement regulation. Table 6-1, below, summarizes the NPDES Requirement history for the Chevron Terminal.

Table 6-1. Chevron NPDES Permits

Order Number / NPDES No.	Title	Adoption Date	Expiration Date
Order No. 74-38, NPDES Permit No. CAS0107476	Waste Discharge Requirements for a Discharge of Storm Water Runoff from a Petroleum Storage Area through a City of San Diego Storm Drain Terminating in San Diego Bay, 350 feet south of the Extension of Sampson Street	November 4, 1974	June 25, 1979
Order No. 79-42, NPDES Permit No. CAS0107476	(same as above)	June 25, 1979	July 16, 1984
Order No. 84-26, NPDES Permit No. CA01074761	(same as above)	July 16, 1984	March 10, 1994
Order No. 94-30, NPDES Permit No. CA0107476	An Order Rescinding Order No. 84-26	March 10, 1994	Order No. 94-30 rescinds Order No. 84-26 since facility discharge is covered by statewide General Industrial Storm Water Permit, Order No. 91-13
Order No. 91-13, NPDES Permit No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities (Statewide General Industrial Storm Water Permit)	June 8, 1992	February 5, 1998
Order No. 97-03-DWQ, NPDES Permit No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	February 5, 1998	Ongoing

6.6 Documented Releases

The following is a summary of the documented releases of petroleum related products from the Chevron facility.

6.6.1 Belt Street Pipeline

On February 1, 2001, the Belt Street Pipeline was ruptured during geotechnical drilling activities for a City of San Diego water project. The drilling was performed by AMEC Earth and Environmental Inc., under contract with the City of San Diego. An estimated 3,000 to 4,000 gallons of gasoline were released (SDUPD, 2004). When neither the City nor AMEC would accept responsibility for the cleanup efforts, Chevron implemented a dual phase extraction (DPE) system at NAS-1 with the use of a thermal oxidizing Mobile Treatment System (MTS). Chevron commenced with the cleanup effort to ensure that there was no adverse effect to San Diego Bay as a result of the pipeline rupture. The Regional Board ultimately issued a Cleanup and Abatement Order to the City of San Diego and AMEC. As a result of the emergency response actions taken by Chevron, and the assessment work performed by the City and/or AMEC, the Regional Board ultimately issued a “no further action” letter to the City and AMEC, dated August 21, 2003 (LFR Levine-Fricke, 2004).

6.6.2 Upper Tank Farm

The Upper Tank Farm area has three documented releases. Most recently, on April 30, 1973, an evidence of an estimated 200 gallons of petroleum was found on the surface of San Diego Bay. The Regional Board identified the Chevron facility as the likely source of the release (SDUPD, 2004). Chevron stated that the investigation was incomplete because 1) Terminal drains were dry at the time of the release, 2) there was no direct evidence of a spill on the Chevron property, 3) there were five openings on the drain line to the Bay, which were not on Chevron Property, but on public streets, and 4) there were no updated drawings which show the drain system does not extend beyond the Chevron property limit (LFR Levine-Fricke, 2004).

On August 14, 1967, an estimated 400-gallon release of diesel fuel due to a leak in a filter gasket was reported by terminal personnel. No further information is available to determine whether the spill reached San Diego Bay. (LFR Levine-Fricke, 2004)

Historical records maintained by the San Diego Fire Department contain a summary of a fire at the Chevron associated facility (originally owned by Standard Oil) in October 1913. A spark from a passing locomotive was reportedly the cause of the fire in a 250,000-gallon tank of distillate oil. This caused a second fire in a 1,500,000-gallon tank of black oil resulting in the explosion of a third, 250,000-gallon tank containing gasoline. The explosion reportedly spread burning gasoline to nearby lumberyards that caught fire as well. The fire burned for 35 hours before it was extinguished. Reportedly the total estimated two million gallons of crude oil and leaded gasoline were destroyed by the fire and/or released into the San Diego Bay. According to the San Diego Union, the burning oil spread out over the bay and nearby lumberyards. (SDUPD, 2004)

6.7 Dredge and Fill Reclamation Projects

Much of the current land area of the NASSCO and BAE Systems leaseholds was created during a major dredge and fill project completed between 1935 and 1936 (SDUPD, 2004). A bulkhead was used to retain the dredged sediment, creating additional land area. It is likely that contaminated sediment present within the dredge and fill areas, such as any that resulted from the 1913 fire, are buried within the fill area behind the bulkhead.

6.8 Petroleum and Ethanol Storage and Handling

Petroleum products are delivered to the Chevron facility via an underground pipeline owned and operated by Kinder Morgan Energy Partners. The pipeline surfaces before it enters the tank farm. The petroleum is transferred to the aboveground storage tanks (ASTs) within the containment walls of the tank farm, and it is transferred to tanker trucks via aboveground piping. Storm water from the tank farm is collected in an underground storage tank, sent to a clarifier for processing, and only then discharged to the storm sewer system (LFR Levine-Fricke, 2004).

Ethanol is transferred directly from railcars to the facility on the day of arrival via aboveground piping. Terminal personnel manually connect the tank cars before the transfer is started and are present during the transfer. The ethanol facility, which includes a railspur, is underlain by a double containment system designed to capture any accidental releases of ethanol during off-loading operations (LFR Levine-Fricke, 2004).

6.9 Comparison of Shipyard Sediment Data to Location of Chevron Facilities

The former Chevron fueling pier, now known as the National Steel Marine Terminal Pier 1, is located near the boundary between BAE Systems and NASSCO, and south of BAE Systems Pier 4. The Shipyard Report (Exponent, 2003) sediment sampling sites SW20 through SW25 are located between BAE Systems' Piers 3 and 4 (which is northwest of the Chevron Lower Tank Farm site).

Review of the shipyard sediment sampling data for high molecular weight PAHs (HPAHs) shows that some of the highest concentrations are north of the former Chevron fueling pier (National Steel Marine Terminal Pier 1) and both lower tank farms (Exponent, 2003). Table 6-2 shows the HPAH sampling results for selected sampling stations in the vicinity of the Chevron facilities and in the vicinity of the mouth of Chollas Creek. For comparison purposes the background sediment concentration for HPAHs is 673 µg/kg.

Table 6-2. Sediment Sampling Results for HPAHs

Station	Depth (Feet)	HPAH (µg/kg)	Station Location Description
SW 20	Surface 0 – 1.5 1.5 – 2.42	11,000 6,300 400	Approximately 200 feet southwest of the former Chevron lower tank farm.
SW 24	Surface 0 – 2 2 – 3	58,000 17,000 2,900	Approximately 270 feet southwest of the former Chevron lower tank farm.
SW 27	Surface 0 – 2 2 – 4.24 5.29 – 5.6	12,000 3,800 630 37	Approximately 260 feet southwest of the Standard Oil pipelines.
SW 28	Surface 0 – 2 2 – 4 4 – 5.29	20,000 25,000 8,700 1,900	Approximately 100 feet southwest of the Standard Oil pipelines and approximately 300 feet west of the former fueling pier.
NA 01	Surface 0 – 2 2 – 4 5 – 5.5	7,400 7,200 9,100 8,800	Less than 100 feet west of the mid-point of the former fueling pier.
NA 23	Surface 0 – 2 2 – 4	3,400 8,500 4,200	Approximately 100 feet south of the Chevron wharf lease and approximately 300 feet east of the fueling pier and pipelines.
NA 20	Surface 0 – 2 2 – 4 4 – 6 6 – 8.1	2,900 2,400 4,000 2,500 1,200	Near mouth of Chollas Creek
NA 21	Surface 0 – 2 2 – 4 4 – 6 6 – 7.6	2,100 6,100 3,200 460 < 15	Near mouth of Chollas Creek
Background	NA	673	Based on 95 % upper prediction limit of reference stations

(Exponent, 2003; LFR Levine-Fricke, 2004)

The Table 6-2 data indicates that:

- Stations SW20 through SW24, located closest to the former Chevron lower tank farm (between Piers 3 and 4), have considerably higher HPAH results than the stations located closest to the mouth of Chollas Creek for most depth intervals. This suggests source(s) other than Chollas Creek have made significant contributions to the accumulation of HPAHs reported in the stations near the former Chevron operations.
- The second highest surface sediment HPAH concentration for the entire Shipyard Sediment Site was reported for station SW24 (58,000 µg/kg).

Sediment deposition and erosional processes in the vicinity of the Shipyard Sediment Site are not well known. Very little evidence of maintenance dredging in the northern portion of the NASSCO lease area has been found in documents, although the nearby area between BAE Systems Piers 1 through 4 was dredged in 1984. It is likely that this dredging removed some of the petroleum hydrocarbon-impacted sediment deposited prior to 1984. Chevron ceased operations at the National Steel Marine Terminal 1 (south of BAE Systems Pier 4) in 1974 (LFR Levine-Fricke, 2004).

6.10 Properties and Sources of Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) are a class of compounds that occur naturally in fossil fuels such as coal and crude oil. PAHs are also present in refined petroleum products including diesel fuel and fuel oil. The PAH make-up of crude oil and refined petroleum products is highly complex and variable and no two sources have the same composition (Nagpal, 1993). Physical and chemical properties of PAHs vary with molecular weight. The solubility in water decreases as the molecular weight increases. Accordingly, PAHs of different molecular weight vary in their behavior and distribution in the environment and in biological effects. For aquatic biota, toxicity increases as molecular weight increases (Eisler, 1987). High molecular weight PAHs (HPAHs) include benzo[a] pyrene. Benzo[a] pyrene has carcinogenic properties and, because of this, is frequently used as an indicator of PAHs (Eisler, 1987).

Major sources of PAHs in the atmosphere include forest and prairie fires (19,513 metric tons), agricultural burning (13,009 metric tons), and refuse burning (4,769 metric tons). The major sources of PAHs to aquatic environments are petroleum spillage (170,000 metric tons) and atmospheric deposition (50,000 metric tons) (Eisler, 1987).

When released to the environment, PAHs become associated with particulate materials. PAHs released into the atmosphere eventually reach the ground as the particles they attach to are deposited. PAHs released in petroleum spills enter the aquatic environment, either directly or via runoff, where they become incorporated into bottom sediment, concentrate in aquatic biota, or experience chemical oxidation and biodegradation (Eisler, 1987).

6.11 Analyses and Evaluations of Petroleum Hydrocarbons

The List Report, submitted by Chevron, states that “chemical analyses of sediment samples taken at the Shipyard Sediment Site … have shown that the high molecular weight polynuclear aromatic hydrocarbons (HPAHs) found in those sediments cannot be traced to products stored, transferred or distributed by Chevron at its San Diego Terminal.” (List, 2005). Chevron reports that, based on independent and Chevron proprietary product analyses, the HPAHs present in the sediment are not present in the Chevron products at the site. Their report suggests that the HPAHs are of coal tar origin.

BP submitted the report “Forensic Geochemical Analysis of TPH and PAH Data Collected from Sediments at Southwest Marine, Inc. [currently BAE Systems], San Diego, CA” (Haddad Report) (Haddad, 2005). The Haddad Report states that the total petroleum hydrocarbons (TPH) and polynuclear aromatic hydrocarbon (PAH) contamination “could not have come from BP Terminal operations.” The report’s conclusions are based their analysis of the data provided in the Shipyard Report (Exponent, 2003). TPH carbon range-based quantifications were used the analysis. The analysis also included using PAH “fingerprinting” and the fact that there are two basic types of PAHs: parent PAHs and alkylated PAHs. Comparisons of the PAH “fingerprints” and TPH carbon ranges were used in the Haddad Report to conclude that the hydrocarbons in shipyard sediment are from pyrogenic sources, not petrogenic sources. PAHs from petrogenic sources would provide evidence of a possible release of PAHs from a bulk storage terminal.

Using the molecular weight technique, TPH can be categorized as gasoline range organics (GRO), diesel range organics (DRO), or residual range organics (RRO). Some petroleum products can fall into more than one category. By graphing the spectrum of molecular weights, a curve of each product or mixture of products, can be generated. GRO was found in inconsiderable amounts in sediment samples with only one detection in over 80 sediment samples. Elevated concentrations of DRO were found in near-shore sediment, while RRO concentrations were found near the northwest corner of the sampling area (at sampling stations SW01 and SW02) and near stormwater outfalls. The lack of GRO in samples suggests sources other than the refined products in the Chevron and BP facilities (Haddad, 2005).

The fingerprinting technique separates the PAHs into six homologous PAH families: naphthalenes, flourenes, dibenzothiophenes, anthracenes/phenanthrenes, fluoranthenes/pyrenes, and chrysenes. Each family is composed of a parent PAH, with no carbon atoms attached to their rings, and the alkylated PAHs with 1 to 4 carbon atoms attached to the parent rings. The amount of each type of PAH found in a sample is then plotted on a graph and grouped according to family. The PAHs can then be grouped according to whether the sample of petroleum product is a petrogenic or pyrogenic sources. Petrogenic sources are derived from petroleum products that have not been exposed to high temperatures such as the petroleum products in storage at the Chevron and BP Terminals. Pyrogenic sources are derived from high temperature processes, and include atmospheric deposition/urban runoff, automobile combustion products, creosote, coal tar, etc. (Haddad, 2005).

The fingerprinting results indicate that the samples collected near the BP and Chevron facilities are composed mainly of pyrogenic sources, thereby excluding the fuels stored at the Chevron and BP Terminals as a possible source of the petroleum hydrocarbons found in bay sediment. One sampling event at sampling station SW24 in August 2002 did show the presence of a petrogenic source, however samples taken before and after this sampling event at the same sampling station did not indicate any petrogenic source product present (Haddad, 2005). Chevron has not used the pier/wharf near the sampling site since 1974, and therefore, is a highly unlikely source of the PAHs found in the sediment during this one sampling event.

Creosote impregnated marine pilings have been shown to be a significant source of PAH contamination in San Diego Bay (Chadwick et al., 1999). At the San Diego Naval Station south of the Shipyard Sediment Site, the Navy has been mitigating the effects of the creosote pilings by replacing them with plastic ones. There are numerous creosote pilings within the Shipyard Sediment Site. Review of a 1942 aerial photograph show several piers, very likely constructed with creosote pilings, in the vicinity of sampling stations SW20 through SW24, SW27, and SW28 listed in Table 6-1 as having some of the highest reported HPAH concentrations. Many of the old piers at the Shipyard Sediment Site have been removed over the long history of shipyard activities. Pyrogenic PAHs can be released from creosote pilings via leaching or by deterioration from ship and boat contact or during removal.

Based on the information that the Regional Board has reviewed to date, it is likely that most of the PAH contamination present at the Shipyard Sediment Site is of pyrogenic origin and not caused by releases from the Chevron Terminal. Potential sources for the pyrogenic PAHs include vehicle combustion products transported via air deposition and/or storm water runoff, and creosote pilings.

7. Finding 7: BP as the Parent Company and Successor to Atlantic Richfield Company

BP owns and operates the Atlantic Richfield Company (ARCO) Terminal, a bulk fuel storage facility with approximately 9 million gallons of capacity located at 2295 East Harbor Drive in the City of San Diego. Fuel products containing petroleum hydrocarbons and related constituents such as polynuclear aromatic hydrocarbons (PAHs) have been stored at ARCO Terminal since the early 1900s. ARCO owned and operated ancillary facilities include a wharf, fuel pier (currently ~~Southwest Marine~~ BAE Systems Pier 4), and a marine fueling station used for loading and unloading petroleum products and fueling from 1925 to 1978, and five pipelines connecting the terminal to the pier and wharf in use from 1925 to 1978. Storm water flows from ARCO Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. ~~Industry-wide operational practices, especially in the years prior to the State of California's passage of the Aboveground Petroleum Storage Act in 1990, often led to discharges from aboveground storage tank facilities such as the ARCO Terminal due to leaks and spills from tanks due to advanced age, defects in design or installation, human error, and equipment failure. Similarly old fueling piers and pipelines were often the sources of releases and leaks due to the same factors. Available records provide evidence of specific discharges of petroleum hydrocarbon pollutants from the ARCO Terminal facility. Elevated concentrations of petroleum hydrocarbon pollutants have been found in soil and ground water at the ARCO Terminal. These pollutants may eventually migrate to San Diego Bay at the Shipyard Sediment Site via various preferential pathways. BP also discharges storm water runoff from ARCO Terminal to San Diego Bay at the Shipyard Sediment Site subject to the terms and conditions of the statewide Industrial NPDES Storm Water Permit. Monitoring reports submitted by BP during the years 2003, 2004, and 2005 indicate elevated levels of petroleum hydrocarbons (benzene, oil and grease) are present in the storm water discharge from the site. Prior to the early 1990s storm water was not analyzed prior to discharge. Based on these considerations BP caused or permitted the discharges of petroleum hydrocarbons into San Diego Bay at the Shipyard Sediment Site. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels, which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Accordingly Chevron is referred to as "Discharger(s)" in this Cleanup and Abatement Order~~. Based on the information that the Regional Board has reviewed to date, there is insufficient evidence to find that discharges from the ARCO Terminal contributed to the accumulation of pollutants in the marine sediment at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance. Accordingly, BP and ARCO are not referred to as "Discharger(s)" in this Cleanup and Abatement Order.

7.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that BP and its predecessor and subsidiary companies, including Atlantic Petroleum, Richfield Oil Company, Richfield Petroleum, Atlantic Richfield, and ARCO Chevron, a subsidiary of ChevronTexaco, should not be named as dischargers in Cleanup and Abatement Order No. R9-2005-0126 because there is insufficient evidence to find that discharges from the ARCO Terminal contributed to the accumulation of pollutants in marine sediment at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance.

7.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;

4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;
6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

7.3 Current and Historical Activities

BP or its predecessor and subsidiary companies, including Atlantic Petroleum, Richfield Oil Company, Richfield Petroleum, Atlantic Richfield, and ARCO, have owned or operated bulk fuels storage and distribution facilities in the vicinity of the Shipyard Sediment Site since approximately 1925. ARCO has submitted a Historical Site Assessment Report (ARCO Report) in response to Regional Board Investigation Order No. R9-2004-0026 (SECOR, 2004).

The following is a summary of the current and historical facilities and activities associated with the ARCO bulk fuels storage and distribution terminal located at 2995 East Harbor Drive in San Diego, California. This information is based in part on reports provided by ARCO/ BP and the Port of San Diego (SECOR, 2004; Haddad, 2005; Woodward-Clyde, 1995).

- In 1925 Richfield Oil Company purchased property on the southwest corner of Sicard Street and Harbor Drive for use as a petroleum terminal. By 1928 the terminal property was developed with buildings and large above ground storage tanks (ASTs).
- Five pipelines ran from the terminal to a fueling pier approximately 700 feet long (currently BAE Systems Pier 4). This area is referred to as the wharf area.
- The fueling pier was used to transfer refined petroleum products from barges to the terminal and for the sale of petroleum products at their marine fueling station.
- The pipelines, fueling pier, and wharf were used for loading and unloading petroleum products from approximately 1925 to 1978.

- The terminal was adjacent to San Diego Bay until the 1930s when dredge material was used to expand the land area with fill, effectively moving the shoreline from what is now approximately Belt Street to the current configuration. As a result of the land area expansion the terminal is now located approximately 700 feet from San Diego Bay.
- Richfield Oil Company had a lease in 1948 (renewed in 1955, 1963, and 1978) with Standard Oil to use Standard Oil's wharf, mooring facilities, and pipelines, and for the right to connect to Standard's pipelines (SECOR, 2004).
- The products handled at the wharf and/or stored at the terminal included gasoline, diesel fuels and stove oil, fuel oils, jet fuel, kerosene, and ethanol (SECOR, 2004).
- Storage and handling of jet fuel (kerosene) was discontinued in 2001.
- Waste product and other liquid wastes at the ARCO Terminal are stored in a waste product tank and periodically trucked off-site for recycling and/or treatment and disposal.

7.4 Storm Water Discharges

Storm water flows from ARCO Terminal enter a City of San Diego MS4 storm drain that terminates at outfall SW4 in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Product storage and handling at the BP facility is currently managed under a Spill Prevention Control and Countermeasure Plan as required by the U.S. EPA. The plan has been implemented by using such measures as secondary containment, tank inspection, and collection sumps, which have been in place since at least 1983. The entire tank farm is bermed with storm water flowing into a drainage basin located on the southern corner of the facility. Storm water from the facility has been sampled and analyzed before it is discharged since the early 1990s as required by law, and prior to that, it was visually inspected for floating hydrocarbons before discharged (SECOR, 2004).

7.5 NPDES Requirement Regulation

Since 1992 waste discharges from the ARCO Terminal facility have been regulated under Waste Discharge Requirements (WDRs) prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. These requirements are referred to as NPDES requirements. BP currently discharges storm water runoff from ARCO Terminal to San Diego Bay at the Shipyard Sediment Site subject under the terms and conditions of the statewide Industrial NPDES Storm Water Permit.

The table below summarizes the NPDES requirement history for the ARCO Terminal.

Table 7-1. ARCO Terminal Facility NPDES Permits

Order Number / NPDES No.	Title	Adoption Date	Expiration Date
Order No. 91-13, NPDES Permit No. CAS000001,	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities (Statewide General Industrial Storm Water Permit)	June 8, 1992	February 5, 1998
Order No. 97-03-DWQ, NPDES Permit No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	February 5, 1998	Ongoing

7.6 Documented Releases

The following is a summary of the documented releases of petroleum related products from the ARCO Terminal (SECOR, 2004).

In 1992, soil and groundwater contamination was identified at the terminal. To date more than 30 groundwater monitoring wells have been installed with liquid phase hydrocarbons (LPH) identified in approximately 12 wells. A Corrective Action Plan recommending vapor extraction and natural attenuation was approved by the San Diego County Department of Environmental Health in February 1997. The remediation system was installed and started in 1998. Manual and active LPH recovery activities since 1992 have resulted in the recovery of approximately 3,147 gallons (SECOR, 2004).

On January 15, 1997, approximately 95 gallons of jet fuel was released. A contractor removed product with a vacuum truck and excavated approximately three cubic yards of soil and gravel. The spill was within the area of influence of the vapor extraction system and therefore incorporated into the system.

On August 7, 1998, approximately 700 gallons of gasoline were released at the terminal near the vapor recovery system at the southwest portion of the site during a Kinder Morgan Pipeline leak. Approximately 100 gallons of product and 80 tons of impacted soil were removed. Soil sampling was conducted to assess the hydrocarbon concentrations left in place after the excavation.

The SECOR report concludes that "…hydrocarbon-impacted soil at the Terminal is generally limited to the property boundaries with limited off-site impact (<100 feet) towards San Diego Bay" and that "…the Terminal-associated LPH and dissolved hydrocarbon plumes are predominately present below the southern and southwestern portions of the Terminal with limited off-site migration (<100 feet) towards San Diego Bay, which is located approximately 750 feet southwest of the site." (SECOR, 2004)

7.7 Properties and Sources of Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) are a class of compounds that occur naturally in fossil fuels such as coal and crude oil. PAHs are also present in refined petroleum products including diesel fuel and fuel oil. The PAH make-up of crude oil and refined petroleum products is highly complex and variable and no two sources have the same composition (Nagpal, 1993). While lighter diesel fuels typically contain less than five percent PAHs, marine diesel fuel may contain as high as ten percent PAHs (IARC, 1989).

Physical and chemical properties of PAHs vary with molecular weight. The solubility in water decreases as the molecular weight increases. Accordingly, PAHs of different molecular weight vary in their behavior and distribution in the environment and in biological effects. For aquatic biota, toxicity increases as molecular weight increases (Eisler, 1987). High molecular weight PAHs (HPAHs) include benzo[a]pyrene. Benzo[a]pyrene has carcinogenic properties and because of this it is frequently used as an indicator of PAHs (Eisler, 1987).

Major sources of PAHs in the atmosphere include forest and prairie fires (19,513 metric tons), agricultural burning (13,009 metric tons), and refuse burning (4,769 metric tons) (Eisler, 1987). The major sources of PAHs to aquatic environments are petroleum spillage (170,000 metric tons) and atmospheric deposition (50,000 metric tons) (Eisler, 1987).

When released to the environment, PAHs become associated with particulate materials. PAHs released into the atmosphere eventually reach the ground as the particles they attach to are deposited. PAHs released in petroleum spills enter the aquatic environment, either directly or via runoff, where they become incorporated into bottom sediment, concentrate in aquatic biota, or experience chemical oxidation and biodegradation (Eisler, 1987).

7.8 Comparison of Shipyard Sediment Data to Location of ARCO/BP Facilities

The former ARCO fueling pier is now known as BAE Systems Pier 4. The Shipyard Report (Exponent, 2003) sediment sampling sites SW20 through SW25 are located between Piers 3 and 4 (which is immediately west of the ARCO/BP tank farm).

Review of the shipyard sediment sampling data for high molecular weight PAHs (HPAHs) shows that some of the highest concentrations are in the vicinity of the former ARCO fueling wharf (between Piers 3 and 4), which seems to be associated with piping within their wharf lease (Exponent, 2003). Table 7-2 shows the HPAH sampling results for selected sampling stations in the vicinity of the ARCO facilities and in the vicinity of the mouth of Chollas Creek. For comparison purposes the background sediment concentration for HPAHs is 673 µg/kg.

Table 7-2. Sediment Sampling Results for HPAHs

Station	Depth (Feet)	HPAH (µg/kg)	Station Location Description
SW 20	Surface 0 – 1.5 1.5 – 2.42	11,000 6,300 400	Approximately 275 feet north of the former ARCO fueling wharf.
SW 24	Surface 0 – 2 2 – 3	58,000 17,000 2,900	Approximately 150 feet north of the former ARCO fueling wharf.
SW 27	Surface 0 – 2 2 – 4.24 5.29 – 5.6	12,000 3,800 630 37	Approximately 200 feet south of the former ARCO fueling wharf.
SW 28	Surface 0 – 2 2 – 4 4 – 5.29	20,000 25,000 8,700 1,900	Approximately 200 feet southeast of the former ARCO fueling wharf.
NA 01	Surface 0 – 2 2 – 4 5 – 5.5	7,400 7,200 9,100 8,800	Less than 100 feet west of the mid-point of the former Chevron fueling pier.
NA 23	Surface 0 – 2 2 – 4	3,400 8,500 4,200	Approximately 100 feet south of the Chevron wharf lease and approximately 300 feet east of the fueling pier and pipelines.
NA 20	Surface 0 – 2 2 – 4 4 – 6 6 – 8.1	2,900 2,400 4,000 2,500 1,200	Near mouth of Chollas Creek
NA 21	Surface 0 – 2 2 – 4 4 – 6 6 – 7.6	2,100 6,100 3,200 460 < 15	Near mouth of Chollas Creek
Background	NA	673	Based on 95 % upper prediction limit of reference stations

(Exponent, 2003; LFR Levine Fricke, 2004)

The Table 7-2 data indicates the following:

- Stations SW20 through SW24, located closest to the former ARCO wharf/pier (between BAE Systems Piers 3 and 4), have considerably higher HPAH results than the stations located closest to the mouth of Chollas Creek for most depth intervals. This suggests source(s) other than Chollas Creek have made significant contributions to the accumulation of HPAHs reported in the stations near the former ARCO operations; and
- The second highest surface sediment HPAH concentration for the entire Shipyard Sediment Site was reported for station SW24 (58,000 µg/kg).

Sediment deposition and erosional processes in the vicinity of the Shipyard Sediment Site have not been documented. Very little evidence of maintenance dredging in the northern portion of the NASSCO lease has been reported, although the area between BAE Systems Piers 1 through 4 was dredged in 1984. It is likely that this dredging would have removed some of the petroleum-hydrocarbon impacted sediment deposited prior to 1978, when ARCO ceased operations at the wharf/pier (Haddad, 2005).

7.9 Analyses and Evaluations of Petroleum Hydrocarbons

The List Report, submitted by Chevron, states that “chemical analyses of sediment samples taken at the Shipyard Sediment Site…have shown that the high molecular weight polynuclear aromatic hydrocarbons (HPAHs) found in those sediments cannot be traced to products stored, transferred or distributed by Chevron at its San Diego Terminal.” (List, 2005). Chevron reports that, based on independent and Chevron proprietary product analyses, the HPAHs present in the sediment are not present in the Chevron products at the site. Their report suggests that the HPAHs are of coal tar origin. The BP facility stores and distributes products very similar to those stored and distributed by Chevron.

BP submitted the report “Forensic Geochemical Analysis of TPH and PAH Data Collected from Sediments at Southwest Marine, Inc. [currently BAE Systems], San Diego, CA”(Haddad Report) (Haddad, 2005). The Haddad Report states that the total petroleum hydrocarbons (TPH) and polynuclear aromatic hydrocarbon (PAH) contamination “could not have come from BP Terminal operations” (Haddad, 2005). The report’s conclusions are based on their analysis of the data provided in the Shipyard Report (Exponent, 2003). TPH carbon range-based quantifications were used the analysis. The analysis also included using PAH “fingerprinting” and the fact that there are two basic types of PAHs: parent PAHs and alkylated PAHs. Comparisons of the PAH “fingerprints” and TPH carbon ranges were used in the Haddad Report to conclude that the hydrocarbons in the shipyard sediment are from pyrogenic sources, not petrogenic sources. PAHs from petrogenic sources would provide evidence of a possible release of PAHs from a bulk storage terminal.

Using the molecular weight technique, TPH can be categorized as gasoline range organics (GRO), diesel range organics (DRO), or residual range organics (RRO). Some petroleum products can fall into more than one category. By graphing the spectrum of molecular weights, a curve of each product or mixture of products, can be generated. GRO was found in inconsiderable amounts in sediment samples with only one detection in over 80 sediment samples. Elevated concentrations of DRO were found in near-shore sediment, while RRO concentrations were found near the northwest corner of the sampling area (at sampling stations SW01 and SW02) and near stormwater outfalls. The lack of GRO in samples suggests sources other than the refined products in the Chevron and BP facilities (Haddad, 2005).

The fingerprinting technique separates the PAHs into six homologous PAH families: naphthalenes, fluorenes, dibenzothiophenes, anthracenes/phenanthrenes, fluoranthenes/pyrenes, and chrysenes. Each family is composed of a parent PAH, with no carbon atoms attached to their rings, and the alkylated PAHs with 1 to 4 carbon atoms attached to the parent rings. The amount of each type of PAH found in a sample is then plotted on a graph and grouped according to family. The PAHs can then be grouped according to whether the sample of petroleum product is a petrogenic or pyrogenic sources. Petrogenic sources are derived from petroleum products that have not been exposed to high temperatures such as the petroleum products in storage at the Chevron and BP Terminals. Pyrogenic sources are derived from high temperature processes, and include atmospheric deposition/urban runoff, automobile combustion products, creosote, coal tar, etc. (Haddad, 2005).

The fingerprinting results indicate that the samples collected near the BP and Chevron facilities are composed mainly of pyrogenic sources, thereby excluding the fuels stored at the Chevron and BP Terminals as a possible source of the petroleum hydrocarbons found in bay sediment. One sampling event at sampling station SW24 in August 2002 did show the presence of a petrogenic source, however samples taken before and after this sampling event at the same sampling station did not indicate any petrogenic source product present (Haddad, 2005). BP has not used the pier/wharf near the sampling site since 1978, and therefore, is a highly unlikely source of the PAHs found in the shipyard sediment during this one sampling event.

Creosote impregnated marine pilings have been shown to be a significant source of PAH contamination in San Diego Bay (Chadwick et. al, 1999). At the San Diego Naval Station, the Navy has been mitigating the effects of the creosote pilings by replacing them with plastic ones. There are numerous creosote pilings within the Shipyard Sediment Site. Review of a 1942 aerial photograph show several piers, very likely constructed with creosote pilings, in the vicinity of sampling stations SW20 through SW 24, SW 27, and SW 28 listed in Table 7-1 as having some of the highest reported HPAH concentrations. Many of the old piers at the Shipyard Sediment Site have been removed over the long history of shipyard activities. Pyrogenic PAHs can be released from creosote pilings via leaching or by deterioration from ship and boat contact or during removal.

Based on the information that the Regional Board has review to date, it is likely that most of the PAH contamination present at the Shipyard Sediment Site is of pyrogenic origin and not caused by releases from the ARCO Terminal. Potential sources for the pyrogenic PAHs include vehicle combustion products transported via air deposition and/or storm water runoff, and creosote pilings.

8. Finding 8: San Diego Gas and Electric, A Subsidiary of Sempra Energy Company

~~San Diego Gas and Electric, a subsidiary of Sempra Energy Company (hereinafter SDG&E) owned and operated the Silvergate Power Plant along the north side of the Southwest Marine leasehold from approximately 1943 to the 1990s. SDG&E utilized an easement to San Diego Bay along Southwest Marine's north property boundary for the intake and discharge of cooling water via concrete tunnels at flow rates ranging from 120 to 180 million gallons per day. SDG&E operations included discharging waste to holding ponds above the tunnels near the Shipyard Sediment Sites.~~ SDG&E (1) has caused or permitted pollutants from its power plant operations, including metals (~~chromium, iron,~~ copper, ~~lead,~~ nickel, and zinc)~~, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), total suspended solids, and petroleum hydrocarbons~~ to be discharged to San Diego Bay in violation of waste discharge requirements ~~prescribed by the Regional Board~~ and (2) discharged waste or deposited waste where it would probably be discharged, including metals (chromium, copper, lead, nickel, and zinc), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH-d and TPH-h), into San Diego Bay creating, or threatening to create, a condition of pollution or nuisance. ~~Polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) were discharged or deposited where it would be discharged to a City of San Diego storm drain system leading to San Diego Bay at the Shipyard Sediment Site creating or threatening to create a condition of pollution and nuisance. In addition, polychlorinated biphenyls (PCBs) residues are present in the location of the former waste holding ponds where it was discharged or deposited where it would be discharged threatens to discharge to San Diego Bay at the location of the Shipyard Sediment Sites, creating or threatening to create a condition of pollution and nuisance.~~ Based on these considerations SDG&E is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

San Diego Gas and Electric, a subsidiary of Sempra Energy Company (hereinafter SDG&E) owned and operated the Silver Gate Power Plant along the north side of the Southwest Marine BAE Systems leasehold from approximately 1943 to the 1990s. SDG&E utilized an easement to San Diego Bay along Southwest Marine's BAE Systems' north property boundary for the intake and discharge of cooling water via concrete tunnels at flow rates ranging from 120 to 180 million gallons per day. SDG&E operations included discharging waste to holding ponds above the tunnels near the Shipyard Sediment Sites.

8.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that San Diego Gas and Electric (SDG&E) should be named as a discharger in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

8.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;

6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

8.3 Historical Activities

SDG&E owned and operated the Silver Gate Power Plant from 1943 through 1984 (Gonzales, 2005). The plant includes four steam turbine electrical generators. The boilers initially burned fuel oil, and in later years were converted to burn both natural gas and fuel oil (ENV America, 2004a).

SDG&E maintained an easement to San Diego Bay for cooling water discharge lines (CW discharge lines) needed to deliver and remove seawater used for cooling the turbines. This water was non-contact cooling water and the only chemical added to the circulating water was chlorine, which was used to reduce biofouling. Prior to 1978, boiler blowdown (relatively clean water from the steam system that contained settled and precipitated solids) was routed directly to the CW discharge tunnels. Boiler blowdown water may have contained solids and low-level metals. After 1978, the blowdown water was tested for iron and copper and then either treated and discharged to the bay, or directly discharged to the Bay. Additionally, basement bilge water (liquids that accumulated in trenches in the plant basement from the turbine side of the plant) was piped into the CW discharge tunnels. Potential releases in the bilge water may have included oil and grease from equipment lubrication, total suspended solids from water system drains, and possible service system water leaks or spills that contained chromium VI. The location of the easement for the CW discharge tunnels was between the San Diego Marine Construction (now the location of BAE Systems) leasehold and the Kelco leasehold. (ENV America, 2004b; SDUPD, 2004).

Historical photographs indicate that there were two wastewater settling/evaporation ponds and two subgrade oil/water separators on the SDG&E easement. SDG&E reported that basement bilge water from the boiler side of the plant was pumped to a pond for settling and evaporation and that some of the water from the pond was discharged to the Bay. Historical photographs also indicate that a surface spill at Pond A occurred in 1952 when a plug in piping led to overflow of liquid onto the adjacent ground. Pond B was used from 1966 to 1973 as an oil-water settling pond (ENV America, 2004a, b).

SDG&E reported that the facility had transformers onsite. The transformers were contained within concrete sumps as part of the spill prevention and control plan measures for secondary containment for oil storage units (ENV America, 2004b).

Silver Gate Power Plant was taken off-line by 1984 and was maintained in mothball status until several years ago. The plant itself is still standing and SDG&E has a current lease for the tideland easement with the Port District. SDG&E planned to begin disassembly and removal of the boilers and turbine generating units in late 2004. The ponds were filled in at some unknown time in the past (ENV America, 2004b; SDUPD, 2004).

8.4 Site Characteristics, Hydrology and Hydrogeology

Based on a review of the United States Geological Survey (USGS), Point Loma, California 7.5-minute quadrangle map (1994), the Silver Gate Power Plant facility is currently situated within the low-lying area developed near San Diego Bay. Elevations at the site range from approximately 10 to 30 feet above mean sea level. Based on topographic conditions, surface drainage is generally to the west and southwest toward Chollas Creek and San Diego Bay. Based on the proximity to San Diego Bay and Chollas Creek, the depth to groundwater in the study area is estimated at between 10 and 20 feet below ground surface (SDUPD, 2004).

8.5 SDG&E Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirements

SDG&E has caused or permitted pollutants from its power plant operations to be discharged to San Diego Bay in violation of waste discharge requirements. The pollutants include copper, nickel, and zinc.

Waste discharges from the SDG&E facility have historically been regulated under NPDES requirements prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. SDG&E was to comply with all terms of an NPDES Permit in order to lawfully discharge pollutants to surface waters. Any noncompliance of NPDES Permit requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304.

SDG&E NPDES Permit requirement violations are documented in the Regional Board records in monitoring reports submitted during the years 1990 through 1994. SDG&E's discharges of waste in violation of waste discharge requirements are presented below in Section 8.8 of this Technical Report.

8.6 SDG&E's Discharges Have Created Pollution, Contamination, and Nuisance Conditions in San Diego Bay

Based on the information regarding the historical activities provided in Sections 8.3, 8.8, 8.9, and 8.10, the Regional Board has determined that SDG&E is responsible for discharging pollutants including metals (chromium, copper, lead, nickel, and zinc), PCBs, PAHs, TPH-d, and TPH-h to San Diego Bay at the Shipyard Sediment Site as a result of their operations at the Silver Gate Power Plant. As described in Table 8-5 and in later sections of this Technical Report, these same pollutants in the discharges have accumulated in San Diego Bay sediment adjacent to the MS4 Storm Drain SW4 described in Section 4.0 of this Technical Report at the BAE Systems facility portion of the Shipyard Sediment Site in concentrations that adversely affect the beneficial uses of San Diego Bay.

PCBs are a family of organic compounds that are produced by substituting chlorine atoms for hydrogen atoms on a biphenyl molecule. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were commonly used in onsite industrial applications including electrical, heat transfer, and hydraulic equipment. From 1929 to 1977 700,000 tons of PCBs were produced in the United States and an estimated 141,000 tons of pure PCBs remained in service at the end of 1988 (EPA, 2006). The majority of PCBs were used in the production of dielectric fluids for transformers, capacitors, and other electrical components. Concern over the toxicity and persistence in the environment of PCBs led Congress in 1976 to enact section 6(e) of the Toxic Substances Control Act (TSCA) that included, among other things, prohibitions on the manufacture, processing, and distribution in commerce of PCBs.

The evidence of PCB discharges is of particular concern as PCB sediment concentration levels in the vicinity of the MS4 Storm Drain SW4 are the highest in the Shipyard Sediment Site. The discharge of PCBs from the MS4 Storm Drain SW4 and from the wastewater ponds to San Diego Bay can cause a condition of pollution, contamination, and nuisance in San Diego Bay through the following pathways:

***PCB Bioaccumulation*.** PCBs tend to be sorbed to bay bottom marine sediment and are transported and deposited with bay sediment. Bay sediment re-suspension can reintroduce PCBs into the aquatic environment and extend their environmental impacts. Fish and other aquatic organisms are exposed to PCBs through direct intake of contaminated water and sediment, or through consumption of contaminated food. PCBs have the potential to bioaccumulate in organisms and biomagnify through the food chain.

Human Health Threat. The accumulation of PCBs in the sediment is a threat to human health primarily through the consumption of fish and shellfish contaminated by PCBs in the sediment through the processes of bioaccumulation and biomagnification. Other potential pathways of exposure include direct contact with contaminated sediment by swimmers or divers and incidental ingestion of contaminated sediment or associated water by swimmers or divers.

As described in Sections 12 through 29 of this Technical Report these same pollutants have accumulated in San Diego Bay sediment at levels that:

1. Adversely affect the beneficial uses of San Diego Bay, violating a NPDES requirement prohibitions pertaining to discharges that cause pollution, contamination, or nuisance conditions in San Diego Bay; and
2. Violate NPDES requirements pertaining to discharges that degrade marine communities, cause adverse effects on the environment or the public health, or result in harmful concentrations of pollutants in marine sediment.

Accordingly, it is concluded that SDG&E has caused or permitted the discharge of waste to San Diego Bay in a manner contributing to the creation of pollution or nuisance conditions at the Shipyard Sediment Site. It is therefore appropriate for the Regional Board to issue a cleanup and abatement order naming SDG&E as a discharger pursuant to Water Code section 13304.

8.7 NPDES Requirement Regulation

Waste discharges from the SDG&E facility have historically been regulated under NPDES requirements prescribed by the Regional Board pursuant to Clean Water Act section 402 and Water Code section 13376. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and California Water Code is grounds for enforcement action, including but not limited to, the issuance of a Cleanup and Abatement Order under Water code section 13304.

SDG&E discharged plant process water to San Diego Bay from the SDG&E facility to the Shipyard Sediment Site subject to the terms and conditions of NPDES permits for plant process waters and storm water, respectively. A listing of the plant process water NPDES requirements adopted by the Regional Board is provided below.

Table 8-1. SDG&E's Plant Process Water NPDES Permits

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
Order No. 76-9, NPDES No. CA0001376	Waste Discharge Requirements For San Diego Gas And Electric Company Silver Gate Power Plant San Diego County	May 10, 1976	January 28, 1985
Order No. 85-07, NPDES No. CA0001376	Waste Discharge Requirements For San Diego Gas & Electric Company Silver Gate Power Plant San Diego County	January 28, 1985	April 13, 1995

In 1992, SDG&E's Silver Gate Power Plant obtained coverage under the State Water Board's 1991 General Industrial NPDES Requirements for storm water discharges. These NPDES requirements supplemented SDG&E's NPDES requirements listed in Table 8-1. The industrial storm water NPDES requirements applied specifically to discharges of pollutants through storm water, while the NPDES permits listed in Table 8-1 applied to plant process water. The General Industrial NPDES Requirements for storm water discharges adopted by the State Water Board in effect at the time the facility was operated by SDG&E is provided in Table 8-2 below.

Table 8-2. SDG&E General Industrial Storm Water NPDES Requirements

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
91-13-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	November 19, 1991 (Notice of Intent Filed April 7, 1992)	April 17, 1997 (Notice of Intent Filed September 12, 1997)

The General Industrial Storm Water Permit required SDG&E to develop and implement plans to limit its discharges of pollutants from storm water runoff into San Diego Bay. Rather than relying on specific numerical effluent limitations, the General Permit directed SDG&E to create and follow "Best Management Practices"[67] (BMPs). The General Industrial Storm Water NPDES Requirements also required SDG&E to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) and a storm water Monitoring and Reporting Program Plan (MRPP).

8.7.1 Order No. 76-9, NPDES Permit No. CA0001376

Order No. 76-9, NPDES Permit No. CA0001376, in effect from May 10, 1976 to January 28, 1985, contained the following narrative limitations that relate to the discussions contained herein:

- A. EFFLUENT LIMITATIONS … 1.D. The discharge of polychlorinated biphenyls is prohibited.
- A. EFFLUENT LIMITATIONS…1.F. The discharge of chemicals or other wastes not described in the findings of this Order and the discharger’s Report of Waste Discharge is prohibited.
- C. PROVISIONS…5. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination or nuisance as defined by the California Water Code.
- B. PROVISIONS … 8. This order includes Items 1, 2, 4, 5, 6, 7, 8, 9, 10 and 11of the attached “Standard Provisions.”

  Standard Provisions … 1. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under federal, state, or local laws, nor guarantee the discharger a capacity right in the receiving waters. … 2. The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited. … 4. The discharger shall permit the Regional Board: (a) Entry upon premises in which an effluent source is located or in which any required records are kept; (b) access to copy any records required to be kept under terms and conditions of this order; (c) inspections of monitoring equipment or records, and (d) sampling of any discharge. … 5. All discharges authorized by this order shall be consistent with the terms and conditions of this order. The discharge of any pollutant more frequently than or at a level in excess of that identified and authorized by this order shall constitute a violation of the terms and conditions of this order. … 6. The discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with the waste discharge requirements.

[67] Best management practices (“BMPs”) means schedules of activities, prohibitions of maintenance procedures, and other management practices to prevent or reduce the pollution of “waters of the United States.” BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

> … 7. Collected screenings, sludges, and other solids removed from liquid wastes shall be disposed of at a legal point of disposal, and in accordance with the provisions of Division 7.5 of the California Water Code. For that purpose of this requirement, a legal point of disposal is defined as one for which waste discharge requirements have been prescribed by a Regional Water Quality Control Board and which is in full compliance therewith. … 8. After notice and opportunity for a hearing, this order may be terminated or modified for cause, including, but not limited to: (a) violation of any term or condition contained in this order; (b) obtaining this order by misrepresentation, or failure to disclose fully all relevant facts; (c) a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge. … 9. If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under section 307(a) of the Federal Water Pollution Control Act, or amendments thereto, for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this order, the Board will revise or modify this order in accordance with such toxic effluent standard or prohibition and so notify the discharger. … 10. There shall be no discharge of harmful quantities of oil or hazardous substances, as specified by regulation adopted pursuant to section 311 of the Federal Water Pollution Control Act, or amendments thereto. … 11. In the event the discharger is unable to comply with any of the conditions of this order due to: (a) breakdown of waste treatment equipment; (b) accidents caused by human error or negligence; or (c) other causes such as acts of nature. The discharger shall notify the Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.

8.7.2 Order No. 85-07, NPDES Permit No. CA0001376

Order No. 85-07, NPDES Permit No. CA0001376, in effect from January 28, 1985 to April 13, 1995, contained the following narrative limitations that relate to the discussions contained herein:

- A. PROHIBITIONS … 2. The discharge of polychlorinated biphenyl compounds, such as those commonly used for transformer fluid, is prohibited.
- B. DISCHARGE SPECIFICATIONS … 2. The Silver Gate Power Plant discharge to San Diego Bay shall be essentially free of: (b) Settleable material or substances that form sediments which degrade benthic communities or other aquatic life; (c) Substances toxic to marine life due to increases in concentrations in marine waters or sediments.

- D. RECEIVING WATER LIMITATIONS. The Silver Gate Power Plant discharge to San Diego Bay shall not by itself or jointly with any discharge or discharges cause the following water quality objective to be violated: … 1. Physical Characteristics … (d) Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses. … 5 Toxicity … (a) All waters shall be maintained free of toxic substances in concentrations that are toxic to or that produce detrimental physiological responses in human, plant, animal, or aquatic life.
- E. PROVISIONS … 1. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined by Section 13050 of the California Water Code.

8.7.3 Order No. 91-13-DWQ, NPDES Permit No. CAS000001, General Industrial NPDES Requirements for Storm Water Discharges

Order No. 91-13-DWQ, NPDES Permit No. CAS000001, in effect from April 7, 1992 to September 12, 1997 contained the following key narrative limitations that relate to the discussions contained in herein:

- A. DISCHARGE PROHIBITIONS: … 3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance; and
- B. RECEIVING WATER LIMITATIONS. … 1. Storm water discharges to any surface or ground water shall not adversely impact human health or the environment.

8.8 SDG&E's Process Water Monitoring for Plant Process Water NPDES Requirements

SDG&E discharged plant process water to the Shipyard Sediment Site subject to the terms and conditions of two NPDES Permits beginning in 1976 and ending in 1995 when the plant was decommissioned.

Between 1985 and 1995, Order No. 85-07, NPDES Permit No. CA0001376 established monitoring requirements, numerical waste discharge limitations, and narrative waste discharge limitations. The narrative waste discharge limits were in the form of a Discharge Specification which set a narrative limit on discharge pollutant concentrations with intent to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

During the permit cycle, SDG&E stayed within the permit specified numerical limitations for copper, nickel, and zinc, but the Regional Board also required that the discharge from SDG&E not cause a violation of the Discharge Specifications presented in Section 8.7.2, above. During that time, SDG&E violated narrative waste discharge limitations by discharging constituents at levels that were elevated compared to levels established by the California Toxics Rule (CTR) for saltwater[68].

U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included in any of the NPDES Permits issued to SDG&E. However, the numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in water is detrimental to its beneficial uses. By comparing CTR values with historical discharges, the Regional Board is able to determine which discharges *may* have contributed to toxic chemical concentrations in marine water, marine life, and sediment at the shipyard sediment site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an *elevated probability* that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges *did* cause toxic chemical concentrations in marine water, marine life, and sediment, and/or *did* contribute to the present condition of pollution at the shipyard sediment site, there exists an NPDES violation.

To the extent that SDG&E's discharge was elevated above these values and caused violations of the above Discharge Specifications by causing toxic chemical concentrations in marine water, marine life, and sediment, and/or contributed to the present condition of pollution at the shipyard sediment site, the following specific discharges are violations of narrative limits of Order No. 85-07, NPDES Permit No. CA0001376. Monitoring data provided by SDG&E during the years 1990 through 1994 indicate that elevated levels of copper, nickel, and zinc were present in the water discharged from the site when compared to levels established by the CTR for saltwater. Specific discharges are cited below in Table 8-3.

[68] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

Table 8-3. Discharges above CTR Values Occurring from 1990 to 1994

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Source	Citation[3]
January-June 1990	Copper	0.025 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1990	Nickel	0.089 mg/L	0.0082 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1990	Zinc	0.081 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
July-December 1990	Copper	0.019 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1991	Copper	0.01 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1991	Zinc	0.16 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
July-December 1991	Copper	0.012 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
July-December 1991	Zinc	0.19 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Source	Citation[3]
January-June 1992	Zinc	0.094 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
July-December 1992	Copper	0.031 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
July-December 1992	Zinc	0.16 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1993	Copper	0.025 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1993	Zinc	0.13 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1994	Copper	0.018 mg/L	0.0031 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1
January-June 1994	Zinc	0.12 mg/L	0.081 mg/L	Sections 8.5 and 8.6	SDG&E Monitoring Report	Order No. 85-07, B. Discharge Specifications 2b and 2c, D. Receiving Water Limitations 1d and 5a, and E. Provisions 1

[1] 40 CFR 131.38
[2] Reference to Section 8.5 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 8.6 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 8.5 and 8.6.
[3] The cited waste discharge requirement(s) can be found in Section 8.7 of this Technical Report.

8.9 Unauthorized Discharge of Toxic Pollutants into the MS4

The City of San Diego reported that on October 3, 2005, they conducted an investigation and observed evidence of an illegal discharge into the MS4 catch basin on the north side of Sampson Street between Belt Street and Harbor Drive, approximately 10 feet east of the railroad line that runs parallel with Belt Street. Specifically, the catch basin is located immediately to the east of the BAE Systems' parking lot and the SDG&E Silver Gate Power Plant, which is adjacent to the parking lot. During the City's investigation, three sediment samples were collected and analyzed for PCBs and PAHs. The first sample was collected from inside and at the base of a six-inch lateral entering the catch basin from the former Silver Gate Power Plant leasehold. The second sample was collected from inside and at the base of the 12-inch lateral entering the catch basin from another area draining storm water from the facility. The third sample was collected from the 18-inch pipe exiting the catch basin and conveying urban runoff to San Diego Bay at the Shipyard Sediment Site. The results of these three samples, presented in Table 8-1 below, indicate the presence of both PCBs and PAHs entering the municipal storm water system from SDG&E's former Silver Gate Power Plant leasehold and exiting the municipal storm drain system catch basin to San Diego Bay and resulted in the City of San Diego issuing a Notice of Violation (NOV) to SDG&E (Zirkle, 2005a; Kolb, 2005b).

Table 8-4. City of San Diego MS4 Sediment Sample Results for PCBs and PAHs on October 3, 2005

Constituent	Effects Range-Low (ERL)(1) µg/kg	Effects Range-Median (ERM) (1) µg/kg	Alternative Sediment Cleanup Levels µg/kg	6" Lateral µg/kg	12" Lateral µg/kg	Catch Basin µg/kg
Aroclor-1016				< 50	< 50	< 50
Aroclor-1221				< 50	< 50	< 50
Aroclor-1232				< 50	< 50	< 50
Aroclor-1242				< 50	< 50	< 50
Aroclor-1248				< 50	< 50	< 50
Aroclor-1254				650	130	260
Aroclor-1260				720	120	360
Aroclor-1262				< 50	< 50	< 50
Sum of Aroclors®	22.7(2)	180(2)	420(3)	**1,370**	**250**	**620**
Naphthalene(4)	160	2,100		70	330	170
Acenaphthylene(4)	44	640		< 50	< 50	< 50
Acenaphthene(4)	16	500		< 50	< 50	< 50
Fluorene(4)	19	540		< 50	< 50	< 50
Phenanthrene(4)	240	1,500		210	140	< 50
Anthracene(4)	85.3	1,100		< 50	< 50	< 50
Fluoranthene(5)	600	5,100		< 50	< 50	3,300
Pyrene(5)	665	2,600		500	170	91
Benzo [a] Anthracene(5)	261	1,600		450	< 50	< 50
Chrysene(5)	384	2,800		210	65	< 50
Benzo [b] Fluoranthene(5)	NA	NA		260	67	< 50
Benzo [k] Fluoranthene(5)	NA	NA		160	110	< 50
Benzo [a] Pyrene(5)	430	1,600	1,010	130	59	< 50
Dibenz [a,h] Anthracene(5)	63.4	260		< 50	< 50	< 50
Benzo [g,h,i] Perylene(5)	NA	NA		< 50	< 50	< 50
Indeno [1,2,3-c, d] Pyrene(5)	NA	NA		93	< 50	< 50
Total PAHs	4,022	44,792		**2,083**	**941**	**3,391**

(1) Long et al., 1995
(2) ERL and ERM levels are for Total PCBs
(3) Cleanup level is for Total PCB Congeners
(4) LPAH – low molecular weight polynuclear aromatic hydrocarbon
(5) HPAH – high molecular weight polynuclear aromatic hydrocarbon
Non-detections are represented as less than the reporting limit.
(CEL, 2005)

The municipal storm drain system discharges into the BAE Systems leasehold at the Shipyard Sediment Site between Piers 3 and 4. This outfall is indicated as MS4 Storm Drain SW4 in Section 4 of this Technical Report. Sediment sample stations in San Diego Bay from the Detailed Sediment Investigation (Exponent, 2003) in the area of this outfall include SW20 through SW25. The Bay sediment sample results for PCBs and PAHs are presented in Table 8-2.

Table 8-5. NASSCO and Southwest Marine Detailed Sediment Investigation PCB and PAH Results for SW20 through SW25

Constituent	SW20 μg/kg	SW21 μg/kg	SW22 μg/kg	SW23 μg/kg	SW24 μg/kg	SW25 μg/kg
Aroclor-1016	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1221	< 500	< 520	< 57	< 58	< 460	< 51
Aroclor-1232	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1242	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1248	< 250	< 260	< 29	< 29	< 230	< 26
Aroclor-1254	1,500	1,600	670	550	790	330
Aroclor-1260	1,600	1,800	790	710	870	380
Sum of Aroclors®	**3,100**	**3,400**	**1,500**	**1,300**	**1,700**	**710**
Naphthalene(1)	< 13	13	31	< 15	26	< 13
Acenaphthylene(1)	120	130	150	130	290	180
Acenaphthene(1)	16	14	17	19	14	13
Fluorene(1)	53	53	56	53	220	45
Phenanthrene(1)	300	220	330	360	810	260
Anthracene(1)	450	370	500	500	6,000	440
Fluoranthene(2)	930	580	910	960	7,100	750
Pyrene(2)	1,200	850	1,100	1,000	3,100	940
Benzo [a] Anthracene(2)	760	650	890	850	6,300	710
Chrysene(2)	1,800	1,400	1,900	1,800	11,000	1,300
Benzo [b] Fluoranthene(2)	1,500	1,600	1,800	1,500	7,000	2,000
Benzo [k] Fluoranthene(2)	1,200	1,100	1,300	1,200	7,300	1,600
Benzo [a] Pyrene(2)	1,400	1,500	1,700	1,500	8,800	2,000
Dibenz [a,h] Anthracene(2)	200	210	230	220	1,100	240
Benzo [g,h,i] Perylene(2)	770	780	830	820	2,800	800
Indeno [1,2,3-c, d] Pyrene(2)	970	990	1,100	1,000	3,700	1,100
Total PAHs	**11,669**	**10,460**	**12,844**	**11,912**	**65,560**	**12,378**

(1) LPAH – low molecular weight polynuclear aromatic hydrocarbon
(2) HPAH – high molecular weight polynuclear aromatic hydrocarbon
Non-detections are represented as less than the quantitation limit.
(Exponent, 2003)

PCBs in sediment from the laterals and catch basin of the MS4 conveyance were found at levels that exceed the ERL and ERM of 22.7 μg/kg and 180 μg/kg, respectively (Long et al., 1995), as well as the proposed Alternative Sediment Cleanup Levels.

Sediment PCB levels, specifically Aroclor-1254 and 1260, and sediment PAH levels reported in the MS4 conveyance are also reported in the bay sediment near the storm water outfall as indicated by comparing Tables 8-1 and 8-2. This data provides evidence that discharges from the SDG&E facility have contributed to the pollution in the Shipyard Sediment Site.

At the time of the writing of this Technical Report, SDG&E had cleaned the catch basin in response to the NOV and was in the process of determining the origination of the 6-inch and 12-inch storm drains (Kolb, 2005a). SDG&E had been granted an extension to the NOV in order to continue investigating the potential source(s) of pollutants (Zirkle, 2005b).

8.10 Characterization of Wastewater Pond Operations and Discharge to San Diego Bay

Soil boring samples taken at the locations of the former wastewater ponds found residual metals, PAH, and PCB contamination. The proximity of the ponds to San Diego Bay and evidence that a discharge happened on at least one occasion provide a potential for discharges that contributed pollution to the Shipyard Sediment Site.

SDG&E Landside Tidelands Lease Area Site Assessment Report describes an investigation that was characterized the potential residual contamination that may be present at the location of two former wastewater pond operations (ENV America, 2004a). These ponds reportedly were used to settle solids and separate oil and grease from bilge water collected from the boiler side of the plant before being discharged to the Bay (ENV America, 2004b).

The investigation included the collection and analysis of seven soil borings and ground water samples. Each boring produced three samples (approximate depth of fill material, pond sediment, and soil underlying the pond sediment) and a groundwater sample. The samples were analyzed for one or more of the following: total petroleum hydrocarbons within the gasoline, diesel, and heavy hydrocarbon ranges (TPH-g, TPH-d, and TPH-h), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals (ENV America, 2004a).

In SDG&E’s July 14, 2004, response to the 13267 investigative order, it is clearly stated that “[s]ome water from the pond was discharged to the Bay” (ENV America, 2004b). However, it is not clear whether both ponds discharged or whether only one of the two ponds discharged to the Bay. In any case, discharge to the Bay from either pond is reason for concern based on the investigation results.

Pond A soil contained low concentrations of organic compounds, including TPH-d and TPH-h, and SVOCs. However, none of the soil samples from Pond A was reported to contain detectable VOCs, PCBs, or appreciable metals.

Soil data from Pond B showed the presence of organic and metal analytes. The occurrence of shallow soil contaminants was generally coincident with what was visually identified to be the base of the former ponds. Hydrocarbon soil concentrations typically decreased rapidly with depth, suggesting limited vertical migration. Chromium and benzo [a] anthracene were detected in one sample from Pond B soil at concentrations above U.S. EPA industrial Preliminary Remediation Goals (PRGs) (ENV America, 2004a).

A comparison of Pond B soil boring results with sediment clean-up levels identifies several constituents at levels that would be of concern, especially if any of this waste stream was discharged to San Diego Bay. Additionally, the presence of residual contamination and the proximity of the pond to San Diego Bay indicate a potential for discharges from the pond to contribute pollution at the Shipyard Sediment Site via storm water runoff or airborne transport during both operation and post operation until the ponds were filled in and covered at some unknown date. The following tables present the data that exceed the effects range low (ERLs), effects range median (ERMs), or the proposed Shipyard Alternative Sediment Cleanup Levels.

Table 8-6. Comparison of Pond B Soil Boring Sample Results with Proposed Shipyard Sediment Cleanup Levels for PCBs and Metals

Constituent	Units	Effects Range-Low (ERL)(1)	Effects Range-Median (ERM) (1)	Alternative Sediment Cleanup Levels	Soil Boring Sample Results	
					B2-2.0(4)	B4-3.0(4)
Total PCBs(2)	µg/kg	22.7	180	420(3)	**380**	**4,400**
Chromium	mg/kg	81	370	81	**4,220**	**131**
Copper	mg/kg	34	270	200	**393**	**868**
Lead	mg/kg	46.7	218	90	**277**	**520**
Nickel	mg/kg	20.9	51.6	20	**125**	**33.8**
Zinc	mg/kg	150	410	300	**1,190**	**1,060**

Long et al., 1995
Sum of Aroclors®, includes detected results for Aroclor-1254 and Aroclor-1260
Cleanup level is for Total PCB Congeners
The first unit of the sample identification indicates the borehole number (e.g., B2) and the second unit indicates the sample depth (e.g., 2.0 feet below ground surface [bgs])

Table 8-7. Comparison of Pond B Soil Boring Sample Results with Proposed Shipyard Sediment Cleanup Levels for Benzo[a]pyrene

Constituent	Units	Effects Range-Low (ERL)[1]	Effects Range-Median (ERM)[1]	Alternative Sediment Cleanup Levels	Soil Boring Sample Results		
					B2-2.0[2]	B5-2.0[2]	B6-2.0[2]
Benzo[a]pyrene	µg/kg	430	1,600	1,010	**2,800**	**1,020**	**3,130**

Long et al., 1995

The first unit of the sample identification indicates the borehole number (B2) and the second unit indicates the sample depth (e.g., 2.0 feet below ground surface [bgs])

Groundwater results indicated low hydrocarbon concentrations detected in both Pond A and B areas. Volatile compounds including chlorinated solvents were detected in groundwater (ENV America, 2004a).

9. Finding 9: United States Navy

The US Navy is referred to as "Discharger(s)" in this Cleanup and Abatement Order based on the following considerations:

a. ***US Navy Floating Dry Dock and Dockside Discharges.*** Between the early 1950s through the early 1970s, the United States Navy (US Navy) owned and operated a floating dry dock (AFDL-37) located within the NASSCO leasehold that was used for naval vessel repair including solvent cleaning and degreasing of vessel parts and surfaces, abrasive blasting for paint removal and surface preparations, metal plating, and surface finishing and painting. The US Navy also used dockside space within the NASSCO leasehold for painting and scraping operations, which generate wastes that can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters. Prevailing industry- wide shipyard operational practices in floating dry docks and adjacent work areas during the 1950s through the 1970s were not sufficient to adequately control or prevent pollutant discharges and often led to uncontrolled discharges of pollutants, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyltin species, polychlorinated biphenyls (PCBs)/ polychlorinated triphenyls\(PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). The types of pollutants found in elevated concentrations at the Shipyard Sediment Site (metals, butyltin species, polychlorinated biphenyls (PCBs)/ polychlorinated triphenyls\(PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH)) are associated with the characteristics of the waste the US Navy operations generated at the NASSCO site. Based on these considerations the US Navy caused or permitted the discharges of these pollutants into the Shipyard Sediment Site. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay.

b. ***Naval Station San Diego Discharges.*** The US Navy also owns and operates a municipal separate storm water conveyance system (MS4) through which it discharges pollutants commonly found in urban runoff including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc); total suspended solids, sediment (due to anthropogenic activities) petroleum products, and synthetic organics (pesticides, herbicides, and PCBs) to Chollas Creek from its Naval Station San Diego facility located at 32nd Street and Harbor Drive in the City of San Diego. The US Navy has caused or permitted the discharge of these urban storm water pollutants through its MS4 to Chollas Creek contributing to exceedances of chronic and acute California Toxics Rule copper, lead and zinc criteria for the protection of aquatic life. U.S. Navy studies indicate that, during storm events, Chollas Creek discharges sediment plumes containing urban runoff pollutants up to 2 kilometers into San Diego Bay over an area including the Shipyard Sediment Site. Based on these considerations the US Navy caused or permitted the discharge of urban runoff pollutants into the Shipyard Sediment Site from its Naval Station San Diego facility. The off-site MS4 discharges cited above have contributed to

~~the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay.~~

The U.S. Navy owns and operates a municipal separate storm sewer system (MS4) at NAVSTA San Diego through which it has caused or permitted the discharge of pollutants commonly found in urban runoff to Chollas Creek and San Diego Bay, including excessive concentrations of copper, lead, and zinc in violation of waste discharge requirements. Technical reports by the U.S. Navy and others indicate that Chollas Creek outflows during storm events convey elevated sediment and urban runoff chemical pollutant loading and its associated toxicity up to 1.2 kilometers into San Diego Bay over an area including the Shipyard Sediment Site. The U.S. Navy has caused or permitted marine sediment and associated pollutants to be resuspended into the water column as a result of shear forces generated by the thrust of propellers during ship movements at NAVSTA San Diego. The resuspended sediment and pollutants can be transported by tidal currents and deposited in other parts of San Diego Bay, including the Shipyard Sediment Site. The discharges cited above have contributed to the accumulation of pollutants in marine sediment at the Shipyard Sediment Site to levels, which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on the preceding considerations, the U.S. Navy is referred to as “Discharger(s)” in this Cleanup and Abatement Order.

From the year 1921 to the present, the U.S. Navy has provided shore support and pier-side berthing services to U.S. Pacific fleet vessels at Naval Station San Diego (NAVSTA San Diego) located at 3445 Surface Navy Boulevard in the City of San Diego. NAVSTA San Diego currently occupies 1,029 acres of land and 326 water acres adjacent to San Diego Bay to the west, and Chollas Creek to the north near Pier 1. Between the years 1938 and 1956 the NAVSTA San Diego leasehold included a parcel of land, referred to as the 28th Street Shore Boat Landing Station, located at the south end of the present day NASSCO leasehold at the foot of 28th Street and including the 28th Street Pier. At this location, the U.S. Navy conducted operations similar in scope to a small boatyard including solvent cleaning and degreasing of vessel parts and surfaces, abrasive blasting and scraping for paint removal and surface preparations, metal plating, and surface finishing and painting. Prevailing industry-wide boatyard operational practices employed during the 1930s through the 1980s were often not sufficient to adequately control or prevent pollutant discharges and often led to excessive discharges of pollutants and accumulation of pollutants in marine sediment in San Diego Bay. The types of pollutants found in elevated concentrations at the Shipyard Sediment Site (metals, butyltin species, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH)) are associated with the characteristics of the waste the U.S. Navy operations generated at the 28th Street Shore Boat Landing Station site.

9.1 Jurisdiction

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

For the reasons set forth below, the Regional Board has determined that the U.S. Navy should be named as a discharger in Cleanup and Abatement Order No. R9-2005-0126 pursuant to Water Code section 13304.

9.2 Admissible Evidence – State Water Resources Control Board Resolution 92-49

On June 18, 1992 (amended on April 21, 1994 and October 2, 1996) the State Water Resources Control Board adopted Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304*. Resolution 92-49 provides that:

I. The Regional Board shall apply the following procedures in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304. The Regional Board shall:

A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;
2. Site characteristics and location in relation to other potential sources of a discharge;
3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;
4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;
5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;

6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;
7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;
8. Reports and complaints;
9. Other agencies' records of possible known discharge; and
10. Refusal or failure to respond to Regional Board inquiries.

9.3 Naval Station San Diego

From 1921 to the present the U.S. Navy has owned and operated the Naval Station San Diego (NAVSTA San Diego). NAVSTA San Diego provides supply and maintenance logistical support to numerous U.S. Navy vessels and is located at 32nd Street and Harbor Drive approximately 3 miles southeast of downtown San Diego on the eastern edge of San Diego Bay. It is bordered by the City of San Diego to the north and east and National City to the south and east and San Diego Bay to the west. NAVSTA San Diego is immediately south of, and adjacent to, the Shipyard Sediment Site, with Chollas Creek separating the two. NAVSTA San Diego's present day leasehold also includes a 24,653 square foot parcel north of Chollas Creek. This parcel is located at the south end of 28th street in the City of San Diego and is immediately adjacent to Chollas Creek.

The following subsections present both historical and current information on NAVSTA San Diego operations, waste materials, and pollutant transport pathways.

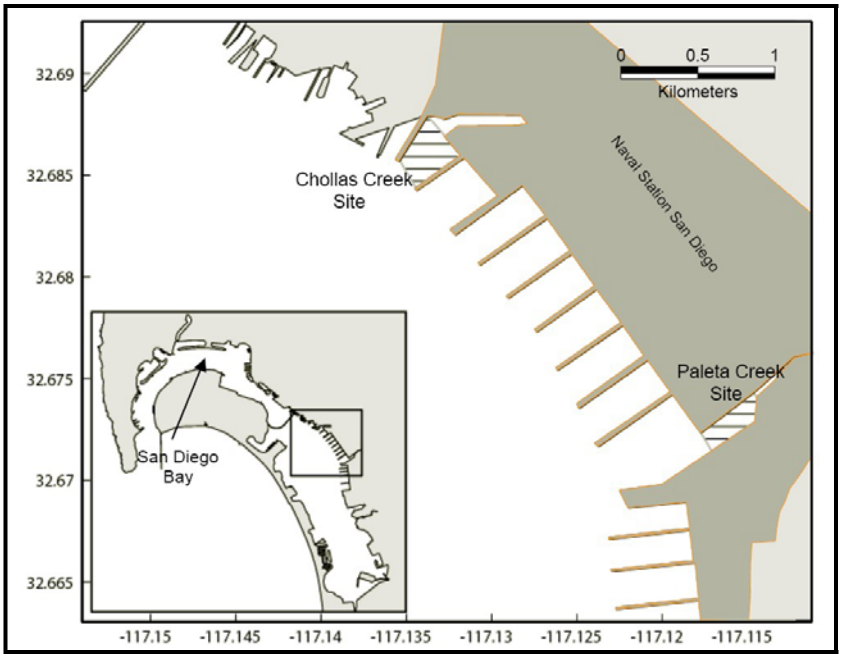

Figure 9-1. Naval Station San Diego

(SCCWRP and U.S. Navy, 2005a)

9.4 Historical Operations

The property on which Naval Base San Diego is now located was deeded to the U.S. government by the City of San Diego on September 3, 1919 to build a docking and fleet repair base. The initial parcel of property consisted of 21 water acres and 77.2 land acres with the former being mostly tidelands and marsh flats. On February 15, 1921, the U.S. Navy acquired the land, buildings, and some machinery to establish a San Diego Ship Repair Base.

In February 1922 the U.S. Navy's U.S. Destroyer Base San Diego began operations at the facility with the mission of maintaining 39 decommissioned naval destroyer vessels. The base was used extensively during the 1920s and 1930s for the repair and maintenance of U.S. Navy Destroyer vessels. The following passage describing this activity is an excerpt from the historical magazine "San Diego's Navy" as quoted in the San Diego Unified Port Districts section 13267 investigative report (SDUPD, 2004):

> *"In mid-1923, the destroyer base was caring for eighty-four decommissioned destroyers. During 1924 seventy-seven of these destroyers were decommissioned and seven recommissioned. Destroyers were hauled up on the marine railway, their hulls cleaned of marine growth and rust and painted (many times with an orange-red paint undercoat that led to the public's nickname of "Red Lead Row" for San Diego's Reserve ships). All machinery was opened, dried, and treated with oil or heavy coats of grease. Piping connections were blanked off to prevent flooding and fuel (sic), and the water tanks were drained and cleaned. When the Navy closed its submarine base in San Pedro during 1923-25, it transferred repair and upkeep responsibility of fleet submarines to San Diego (SDUPD, 2004)."*

From the late 1930s to the late 1940s the base was expanded through a succession of land acquisition and facility development programs. The base expansion included leasing a parcel of property located within the present day NASSCO leasehold (discussed in Section 9.4.2. below). In 1943 the Destroyer Base was renamed U.S. Naval Repair Base San Diego to reflect an expanding industrial capacity and changing role. From 1943 to 1945 more than 5,000 ships were sent to the base for conversion, overhaul, battle damage repair, and maintenance; approximately 2,190 of these ships were dry-docked. In January 1944 the base was expanded to include approximately 823 acres, over 200 buildings, a 1,700 ton marine railway, a cruiser graving drydock, five large repair piers, quay wall totaling 28,000 feet of berthing space and extensive industrial repair facilities. In 1946 the base was designated Naval Station San Diego (NAVSTA San Diego) with the primary mission of providing logistical support, including ship repair and dry docking, to locally based units of the US Naval fleet. NAVSTA San Diego remains in operation and is currently homeport for approximately 60 naval vessels and home base to 50 separate commands.

9.4.1 Installation Restoration Sites

Information on historical operations conducted at NAVSTA San Diego was submitted to the Regional Board under the US Navy's Installation Restoration (IR) program[69]. As a part of the IR an Initial Assessment Study[70] was conducted by the U.S. Navy that identified a number of past activities at NAVSTA San Diego that may have resulted in the discharge of pollutants to San Diego Bay in years past. Information regarding these activities obtained from the Initial Assessment Study as well as subsequent studies[71] is summarized in the subsections below.

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[69] The U.S. Navy's Installation Restoration (IR) program administered under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The purpose of the IR program is to identify, assess, characterize and cleanup or control contamination from past hazardous waste disposal operations and hazardous materials spills at U.S. Navy and Marine Corps installations.

[70] Initial Assessment Study of Naval Station, San Diego, California. SCS Engineers Inc. May 1986.

[71] Navy Clean 3 Program, Final Site Management Plan, Naval Station San Diego, San Diego, California, CTO-0020/0068, July 2002.

9.4.1.1 Former Ship Repair Basins

Between the years 1943 and 1945 more than 5,000 ships were sent to what was then called U.S. Naval Repair Base San Diego for conversion, overhaul, and repair. Many ship repair operations were conducted in four basins that were used as ship repair wet docks. Basins 1 and 2 were located north of present day Pier 11 and Basins 3 and 4 are located south of present day Pier 11, approximately 1.7 miles south of the present day Shipyard Sediment Site. The four basins measured approximately 400 feet long, 80 feet wide and 38 feet deep. The basins were constructed of steel sheet piling with concrete sides and were unlined at the bottom. The basins were enclosed on the San Diego Bay side by a reinforced concrete quay wall that U.S. Navy aerial photographs indicate was in place by 1953. The U.S. Navy reported that hazardous materials were not routinely disposed of in the basins during their years of operation and that less than 1000 gallons of waste oil and sludges were disposed of in the basins between 1940 and 1945.

In 1945 the U.S. Navy ceased use of the basins for ship repair. Decommissioning of naval vessels was conducted at Piers 8 and 12. From 1945 through 1972 Basins 3 and 4 were used as informal disposal sites for hazardous and non-hazardous solid waste. Materials filled and disposed in the ship repair basins included demolition spoil, debris and rubble, solid waste, scrap metals, lubricants and oils from decommissioned ships as well as wastes from other facilities at NAVSTA San Diego. U.S. Navy records indicate that Basins 3 and 4 received approximately 4,200 gallons of oils and sludges. The quantity of debris in the basins is unknown, however the sizes of Basins 3 and 4 indicate they may hold up to 88,000 cubic yards of debris and soil. The U.S. Navy reported that Basins 1 and 2 had a limited period of operation from approximately 1941 through 1945 and that aerial photographs indicate the basins were filled by 1946. Basins 1 and 2 combined may contain up to 118,000 cubic yards of fill material. By 1972 all four ship repair basins were paved over with asphalt and or concrete for use as parking lots or as a site for other facilities.

Chemical constituents identified in Ship Repair Basins 3 and 4 in the U.S. Navy's 1990s IR Program site investigations included lubricants, oils, metals, PCBs, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). In 1998 approximately 16 tons of PCB and PAH impacted soil was removed from the upper 10 feet of Basin 4 as part of an initial cleanup action to eliminate potential human health risks. The impacted soil was hauled to a regulated off-site landfill for disposal.

9.4.1.2 Mole Pier

The Mole Pier is a 22 acre triangular area bounded by 7th Street and Paleta Creek to the north, Cummings Road to the east, and Mole Road to the south. The area is located near present day Pier 9 adjacent to Paleta Creek and only a few hundred feet from San Diego Bay, approximately 1.5 miles south of the Shipyard Sediment Site. Mole Pier was created in 1942 with hydraulic fill material from San Diego Bay. By 1945 Mole Pier was enclosed with earthen berms and designated a disposal area. Materials such as creosote–coated pier pilings, lumber, refuse concrete, waste paints, gasoline, solvents, oil, and diesel fuel were burned at the site between approximately 1945 and 1972. During the 1970s, trucks and heavy equipment were routinely decontaminated by spraying with diesel fuel and using a crane to dunk the vehicles into Paleta Creek. It is estimated that approximately 500,000 gallons of fuel was sprayed, burned, or buried in this area during its years of operation. Hazardous wastes that were burned or buried at the Mole Pier area are listed in Table 9-1 below.

Table 9-1. Hazardous Wastes Burned or Buried at the Mole Pier Area

Waste	Source	Time Period	Estimated Total Quantity
Motor Oils, diesel fuel, gasoline hydraulic fluid	NAVSTA Vehicle Maintenance	1945- 1963	400,000 Gallons
	Naval Repair Facility	1945-1964	140,000 Gallons
Stoddard Solvent	NAVSTA Vehicle Maintenance	1945- 1963	2,800 Gallons
	Naval Repair Facility	1967 - 1972	1,000 Gallons
Mixed Solvents (acetone, MEK, toluene, methylene chloride)	Naval Repair Facility	1945- 1964	6,000 Gallons
	Naval Public Works Center	1967 - 1970	1,000 Gallons
Mineral spirits	Naval Public Works Center	1967 - 1970	18,000 Gallons
Carbon remover (phenol, cresol, chlorinated hydrocarbons)	NAVSTA Vehicle Maintenance	1945 - 1963	500 Gallons
Methylene Chloride	Naval Development and Training Center	1967 - 1972	2,400 Gallons
Chlorinated solvents, unidentified	Naval Development and Training Center	1967- 1972	1,000 Gallons
	Naval Repair Facility	1945 - 1964	20,000 Gallons
Sandblast Grit	Shore Intermediate Maintenance Activity	1950 -1965	320,000 Pounds
	Naval Public Works Center	1963 - 1972	2,700,000 Pounds

Potential pollutant transport mechanisms to Paleta Creek and San Diego Bay during the Mole Pier years of operation (1945 through 1972) include direct deposition, air transport, surface water runoff, and pollutant movement through the highly to moderately permeable (10^{-2} to 10^{-3} cm/sec) fill material underlying the site. Chemical constituents identified at the Mole Pier Site from past discharges in the U.S. Navy's 1990s IR Program site investigations included fuels, oils, solvents, paint sludges, metals, total petroleum hydrocarbons (TPH), VOCs, SVOCs, dibutyltin, monobutyltin, tetrabutyltin, and tributyltin. As of 2001, approximately 64,000 cubic yards of impacted soil was removed from the Mole Pier site as part of an initial cleanup action and hauled to a certified off-site landfill for disposal.

9.4.1.3 Salvage Yard

Between the years 1943 to about 1975 the U.S. Navy operated a salvage yard to receive, sell, donate, and dispose of excess Navy materials in an area approximately 1,050 feet by 300 feet in the south central portion of NAVSTA San Diego. Paleta Creek borders the site to the south – southeast at a point approximately 1.6 miles south of the Shipyard Sediment Site. Harbor Drive and Cummings Road border the site to the northeast and southwest, respectively. The U.S. Navy reports that items and materials handled by the site included transformers containing PCBs, mercury, electrolytes from old batteries, drummed petroleum wastes, solvents and thinners, refuse, demolition debris, infectious wastes from medical and dental clinics, and spoiled food items from incoming Navy vessels. It is estimated that between 100 and 200 drums per month of waste lubricating oil, lubricants, solvents, and acid alkaline solutions were transported to the site during its operation for handling. Liquid waste was typically incinerated, drained onto the ground, or recycled. Material that could not be sold, reused or donated was incinerated at the Site. The U.S. Navy's estimated quantities of pollutants drained onto the ground at the site are presented in Table 9-2 below. Potential pollutant pathways to Paleta Creek and San Diego Bay during the Salvage Yard's years of operation would have included surface water runoff and pollutant movement through the highly to moderately permeable (10^{-2} to 10^{-3} cm/sec) fill material underlying the site. Part of the salvage yard was located adjacent to Paleta Creek, which flows into San Diego Bay approximately 1200 feet west of the salvage yard site.

Table 9-2. Quantity of Pollutants Estimated Drained to Ground

Waste	Source Of Waste	Time Period	Estimated Total Quantity
Dielectric Fluids	Electrical shops at all San Diego Naval Facilities	1943-1975	7,500 – 15,000 Gallons
Mercury	Torpedoes, compasses, ballast tanks	1943-1975	750- 1,800 Pounds
Waste Oils, solvents thinners	All San Diego naval facilities	1943-1975	15,000 – 110,000 Gallons
Battery Acids	Transportation	1943-1975	Unknown Quantity
Silver nitrate	Photo Processing	1943-1975	Unknown Quantity

Chemical constituents identified at the Salvage Yard Site during the course of the U.S. Navy's IR Program site investigation included PCBs and lead. During 1996 - 1997 approximately 22,000 cubic yards of impacted soil were removed from the site as part of a cleanup action. The impacted soil was hauled to a certified off-site landfill for disposal.

9.4.1.4 Defense Property Disposal Office (DPDO) Storage Yard

Between the years 1943 through 1981, a 180,000 square foot area was designated for use as a storage yard. The former storage yard lies east of Harbor Dive and north of Paleta Creek at a point approximately 1.4 miles south of the Shipyard Sediment Site. Prior to 1975 the surface was reportedly oiled regularly as a dust-control measure. The U.S Navy reports that an estimated 35,000 to 75,000 gallons of oil were spread on the site as a dust control measure. This oil consisted of various waste petroleum, oils, and lubricants. In addition, containers of electrical insulating oils were stored at the site during the 1970s. Some of the containers reportedly leaked but no estimated quantities are available. The storage yard was paved with asphalt in 1975 and is currently used for parking and boat storage. Potential pollutant pathways to Paleta Creek and San Diego Bay during the storage yard's years of operation would have included surface water runoff and pollutant movement through the highly to moderately permeable (10^{-2} to 10^{-3} cm/sec) fill material underlying the site. Part of the storage yard was located adjacent to Paleta Creek along its southern edge, which flows into San Diego Bay approximately 1400 feet west of the storage yard site. Chemical constituents identified at the Salvage Yard Site in the U.S. Navy's 1990s IR Program site investigations have included petroleum, PCBs, and metals.

9.4.1.5 City of San Diego Sewage Treatment Plant

Between the years 1943 through 1963 the City of San Diego owned and operated its main sewage treatment plant at a location in NAVSTA San Diego bounded on the east by Harbor Drive, on the south by Vesta Street, and on the north by Knowlton Williams Road. During its initial years of operation from 1943 to 1950, the 14 million gallon per day (MGD) capacity plant was known as the 32nd Street Sewage Treatment Plant. In 1950 the plant capacity was expanded to 40 MGD capacity to accommodate increasing sewage flows resulting from San Diego's rapidly increasing population. The plant was renamed the Bayside Treatment Plant and was also sometimes referred to as the Harbor Drive Treatment Plant. The sewage treatment plant facilities consisted of maintenance and administration buildings, anaerobic digesters, clarifiers, elutriation tanks, sludge handling facilities, and other associated facilities. Effluent from the sewage treatment plant was discharged into an outfall pipeline and conveyed into San Diego Bay at a point 35 feet below the water line near present day Pier 5, approximately 0.9 miles south of the Shipyard Sediment Site. The Bayside Treatment Plant discharge would typically have included pollutants such as biochemical oxygen demand, suspended solids, grease and oils, metals, bacteria, and pathogens.

San Diego Bay water quality conditions drastically deteriorated during the years 1951 – 1963 due to the pollution effects caused by Bayside Treatment Plant discharge and other sewage, sludge, and industrial waste discharges entering the bay from various sources (Fairey et al 1996). Dissolved oxygen concentrations in the Bay declined to about half normal levels and turbidity in the water resulted in a visibility of less than 1 meter. Bait and game fish had virtually disappeared from the Bay. Coliform bacteria were routinely isolated from the Bay at significant levels. In 1955, the State Board of Public Health and the San Diego Department of Public Health declared much of the Bay contaminated, and posted quarantine and warning signs along 10 miles of shoreline. By 1963, sludge deposits from the treatment plant outfall were two meters deep, extended 200 meters seaward, and along 9000 meters of the shoreline. In 1960 the U.S. Navy began to complain that the Bayside Treatment Plant discharge was causing advanced corrosion to the hulls of naval ships while in port and that the sewage plant should be moved [72] (Jamieson, 2002).

In 1960, San Diego voters approved a bond ($42.5 million) for construction of a new Metropolitan Sewerage System to alleviate the severe pollution conditions in San Diego Bay. In August 1963, the new collection, treatment, and ocean disposal system began operation when the Point Loma Sewage Treatment Plant and its two-mile Pacific Ocean outfall became operational. By February 1964, domestic sewage disposal had been totally eliminated in San Diego Bay. Following the termination of the sewage discharge the sludge banks that blanketed the eastern shore of the bay gradually disappeared and dissolved oxygen levels returned to normal.

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[72] The ship hull corrosion was reportedly caused by electrolysis of the very high levels of organic matter present in San Diego Bay waters at the time. The U.S. Navy estimated at the time that the excessive corrosion was costing $1.5 million dollars a year in repairs.

9.4.1.6 Firefighting Training Facility

Between the years 1945 through 1995 the U.S. Navy operated a fire–fighting training facility at a 1000 feet long by 200 feet wide site near Pier 8, approximately 1.3 miles south of the Shipyard Sediment Site. Training fires were lit at the facility using petroleum hydrocarbons, including approximately 3500 gallons per week of jet propellant grade 5 fuel (JP-5) and gasoline. In 1972 the training facility was redesigned with pollution control equipment. Quench water generated from each firefighting exercise was directed into a series of underground concrete tanks in the southwest portion of the site after passing through several oil water separators. Chemical constituents identified in soil and groundwater at the site in the U.S. Navy's IR Program site investigations included benzene, ethylbenzene, toluene, xylenes, and TPH (primarily JP-5) with lesser amounts of gasoline and bunker fuel. Two free product plumes were identified in the ground water resulting from underground pipe leaks at the site in the early 1990s. A multiphase extraction system was operated at the site from 1997 to 2001 that recovered approximately 15,000 gallons of free product. In 1996, the site was paved over and it is now used as a parking lot. The U.S. Navy reported that "the possibility of historical pathways linking site operations at the site and San Diego Bay was uncertain for the years prior to 1972 (when the training facility was redesigned with pollution control equipment).

9.4.1.7 PCB Storage Facility Electrical Storage Yard

Between the years 1981 through 1994 the U.S. Navy operated a PCB storage facility at a location approximately 1200 feet northwest of Paleta Creek and approximately 1000 feet east of San Diego Bay. The site is bounded on the south by Civic Center Drive. This location is approximately 1.2 miles south of the Shipyard Sediment Site. The facility was primarily used for maintenance of electrical equipment, including draining of transformer fluids and storage of fluids containing PCBs. Transformers were historically transported, repaired, and stored on soil, gravel, asphalt, and concrete at various locations throughout the yard. Until the late 1980s no attempt was made to contain fluids or to segregate PCB fluids from other fluids used in the yard. The operation also involved application of waste oil potentially containing PCBs to the ground for dust and weed suppression. The site is currently paved over with asphalt and is currently used as a parking lot. Arochlor 1260 was the primary PCB reported in soil and storm drain samples collected from the site during the course of the U.S. Navy's IR Program site investigation. The reported PCB concentrations ranged from below the detection limit to 18,500 mg/kg. PCB impacted soil was removed from the site and a nearby storm drain inlet in 1994. The Department of Toxic Substances Control certified that the site cleanup and site closure was achieved (i.e. no further remedial action was needed). Potential pollutant transport mechanisms to Paleta Creek and San Diego Bay during its years of operation included direct deposition, air transport, surface runoff, and pollutant movement through the highly to moderately permeable (10^{-2} to 10^{-3} cm/sec) fill material underlying the site.

9.4.1.8 Material Storage Yard

Between the years 1939 through 1995 the U.S. Navy operated an unpaved material storage yard on approximately 5 acres of land within NAVSTA San Diego approximately 800 feet east of San Diego Bay. The site is located approximately 1.2 miles south of the Shipyard Sediment Site in an area bounded by Vesta Street to the north, Woden Street to the south and Ward Road to the west. U.S. Navy aerial photographs indicate that the site was used as an unpaved storage yard for metal finishing, preservation, and packaging at Building 321. Operations conducted at this area from 1955 through 1996 included the use of solvents and corrosives for the cleaning of metals. The site is currently paved over and is primarily used as a parking lot. The primary pollutants identified in soil at the site during the course of the U.S. Navy's IR Program site investigations in the 1990s included metals, PAHs and PCBs. The dominant potential pollutant transport mechanism to San Diego Bay during the storage yard's years of operation was surface water runoff.

9.4.1.9 Brinser Street Parking Area

Between the years 1941 through 1945 the U.S. Navy constructed floating dry docks and barges at a site within NAVSTA San Diego near Pier 7, approximately 1.2 miles south of the Shipyard Sediment Site. Facilities at the site included two shallow creosote dip ponds used to treat lumber on the site. The site was paved over in 1966 and was subsequently used as a parking lot, a staging area for military equipment, and for shipping and receiving. U.S. Navy soil investigations from 1989 through 1992 revealed the presence of petroleum products, PAHs, metals, SVOCs and VOCs. In 1996 about 5,000 tons of PAH impacted soil was excavated and taken off-site to a soil recycling facility. The Department of Toxic Substances Control certified the site cleanup complete in 1998. The dominant potential pollutant transport mechanism to San Diego Bay during the site's years of operation was surface water runoff.

9.4.1.10 Drydock Sandblast Area

The drydock sandblast grit area is located immediately east of Piers 5 and 6, approximately 1.0 mile south of the Shipyard Sediment Site. The site has been used for the overhaul and maintenance of ships, repair of ship components, and contractor equipment storage since 1942. The site includes a dry dock basin that is approximately 700 feet long, 104 feet wide, and 42 feet deep. This dry dock can accommodate vessels up to 688 feet long and 90 feet wide with a 30 foot draft.

The operations at this site were and still remain industrial in nature and include sand blasting and painting of ship components. Sandblasting operations began at the site following construction of the dry dock facility in 1942. Copper abrasive blast material was used on naval vessels in the dry dock to remove anticorrosive and antifouling paints[73] from the hulls of ships. Sand blasting of small ship parts also occurred on the ground outside of the dry dock. Construction drawings reveal that a railcar structure and a sandblast grit storage silo were present in the western portion of the site by 1952. The railcar shelter contained a hopper where copper slag (sandblast grit) was bottom dropped by train. Used grit was reportedly accumulated and collected for recycling. Open-air sand blasting operations took place at the dock until 1993. At that time sandblasting operations reportedly began being conducted under completely tented conditions to eliminate the dispersion of grit via wind.

In October 1992, visible surface contamination consisting of overlying gravel and dark gray grit and dust was removed to approximately 4 inches below grade at the site. The primary pollutants identified in soil at the site during the course of the U.S. Navy's IR Program site investigation included elevated concentrations of arsenic, iron, lead, manganese, thallium, and hexavalent chromium. Ground water samples have indicated elevated levels of copper, nickel, selenium, and dibromochloromethane.

Potential pollutant transport mechanisms to San Diego Bay during the site's years of operation prior to 1993 included air deposition (e.g., windborne dust) and surface water runoff.

9.4.2 Historic Operations within the Present Day NASSCO Leasehold

The U.S. Navy conducted a record review to compile historical information about U.S. Navy leases and use of property within the present day NASSCO shipyard leasehold. The results of the review are contained in the July 15, 2004 technical report entitled *Navy Technical Report Historical Navy Activities at NASSCO Shipyard* (U.S. Navy, 2004) and are summarized below.

Between the years 1938 and 1956 the U.S. Navy occupied a parcel of land at the south end of the current NASSCO leasehold at the foot of 28th Street, including the 28th Street Pier. This parcel was originally leased from the City of San Diego and was considered part of the U.S. Destroyer Base San Diego and was also referred to as the 28th Street Shore Boat Landing Station. The landing consisted of a finger pier that ship launches used to ferry sailors to and from Navy ships moored in San Diego Bay. The remaining northern side of the 28th Street Pier was used for buildings that housed activities including a machine shop, battery shop, planing mill, electric shop, mold loft, mill work office, naval stores, pipe shop, pipe threading area, overhead crane, and boat way. The U.S. Navy reported that information concerning these buildings and activities is limited but it is assumed that the activities were associated with maintaining ships launches and would involve use of materials similar in type to a small boatyard. The U.S. Navy did

[73] Anticorrosive paints generally contain zinc and chromates, while antifouling paints used by the Navy are currently copper based formulations.

not maintain records related to the activities, hazardous materials usage, and any waste releases that may have occurred around NASSCO. Based on the historical record review, the U.S. Navy concluded that the industrial activities it conducted on NASSCO's present day leasehold were limited to maintenance of small boat launches. The U.S. Navy acknowledged the possibility that discharges from their boat launch maintenance operations on the north side of 28th Street Pier to the Shipyard Sediment Site may have occurred. However the U.S. Navy characterized these discharges, if they occurred, as being "limited in scale" and causing "…. a relatively minimal contribution to elevated sediment contaminant concentrations" at the Shipyard Sediment Site. The U.S. Navy also hypothesized that if pollutants were discharged, they would likely have been removed from San Diego Bay as a result of dredging activities when "… the NASSCO drydock was built". The U.S. Navy also reported that they "…were unable to find any records indicating the Navy operated a floating dry dock" for painting and blasting operations on the subject property and that "…records from the activities conducted by shops or ships at NASSCO shipyard have not been maintained."

9.4.2.1 Past Discharges within the Present Day NASSCO Leasehold

The U.S. Navy described the activities at the former 28th Street Shore Boat Landing Station as being associated with "…maintaining ships launches and involving use of materials similar in type to a small boatyard" (U.S. Navy, 2004). However, as described in the preceding section, specific documentation on the U.S. Navy's activities and wastes generated is lacking. In the absence of such direct evidence, the Regional Board may consider relevant direct or circumstantial evidence in determining whether a person shall be required to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304[74].

9.4.2.1.1 Industry–Wide Operational Practices That Have Led to Discharges

Commercial boatyards are somewhat analogous to the U.S. Navy's former 28th Street Shore Boat Landing Station in terms of operations, materials used, and wastes generated. Industry-wide commercial boatyard operational practices that have historically led to discharges is a relevant consideration in determining the extent and types of waste discharges that may have occurred from the 28th Street Shore Boat Landing Station to the Shipyard Sediment Site[75].

[74] See section I.A of the State Water Resources Control Board Resolution No. 92-49, *Policies And Procedures For The Investigation And Cleanup And Abatement Of Discharges Under Water Code Section 13304.*

[75] See section 1.A.4 of State Water Resources Control Board Resolution 92-49.

Boatyards provide services that are necessary to maintain and repair boats. These services include scrubbing boat hulls to remove attached marine organisms, painting and stripping antifouling hull paints, and other repair services. The hull paints typically contain metals that are toxic to marine organisms thereby retarding marine growth below the water line of a vessel[76]. Various inorganic and organic toxic chemicals have been used in antifouling paints. These include cuprous oxide, arsenic, mercury, and organolead[77]. Other products used at boatyards include solvents and petroleum products. The removal of marine organisms and paint from the boat hull may consist of using mediablasting (e.g., sandblasting, plastic media, etc), hydraulic jet spray (hydroblasting or hydrowashing) equipment, or sanding the hull by hand or other mechanical means. Wastes generated from these procedures consist of spent abrasives, wash water, marine growth, old paint, rust, etc.

The various activities at boatyards are typically conducted predominantly in outdoor areas, although some boatyards have indoor working areas as well. The outdoor nature of the majority of these activities exposes various products and waste products to the environment, including impervious surfaces (such as asphalt or concrete surfaces throughout the work areas) and to direct discharges to waters of the State (from work conducted directly over or adjacent to the receiving water). Typical boatyard operations are in close proximity to receiving waters and create the potential for discharge to surface waters via waterborne runoff from impervious surfaces, airborne transport of particulates, and via accidental/illicit pollutant releases from spills or otherwise. Some work at boatyards is also conducted on vessels that remain in, or are returned to the receiving water. This topside or interior work may also result in discharges of wastes or pollutants such as particulates from abrasive blasting, sanding, or spilled paints/solvents to receiving waters.

Best Management Practices implemented by the boatyard industry in San Diego prior to the 1990s were deficient in many respects and led to excessive discharges of waste to San Diego Bay. In 1972, the Regional Board initiated an investigation to determine the amount and kinds of pollutants that entered San Diego Bay from shipbuilding and repair facilities, and boatyard facilities and the possible effects that the pollutants could have on beneficial uses of San Diego Bay. As a result of that investigation, the Regional Board concluded that heavy metal concentrations were higher in bay sediment near boatyards and shipyards than in other parts of San Diego Bay[78]. Additional evidence is documented in the series of cleanup and abatement orders issued by the Regional Board

[76] Fouling of boat hulls by marine organisms significantly increases the friction drag on the boat, resulting in increased fuel consumption and reduction in maximum speed. In addition, the attached biota may also damage the hull, clog seawater piping systems, interfere with operating equipment and sound devices, and enhance the corrosion on metal surfaces.
[77] The use of many of these compounds is currently restricted or has been eliminated. Currently, the most commonly used chemical is cuprous oxide.
[78] See California Regional Water Quality Control Board, San Diego Region, Wastes Associated with Shipbuilding and Repair Facilities in San Diego Bay, June 1972.

to San Diego Bay boatyard owners and operators in the late 1980s[79]. Based on these considerations it is reasonable to assume that best management practices employed by the U.S. Navy at the 28th Street Shore Boat Landing Station during the years of operation (1938 to 1956) were not adequate to prevent discharges to San Diego Bay in the vicinity of 28th Street Pier and that such discharges likely resulted in the accumulation of metals and other pollutants in the marine sediment at that location.

9.4.2.1.2 Site Characteristics and Location in Relation to Other Potential Sources of Discharge

Consideration of Shipyard Sediment Site characteristics and location in relation to other potential sources of discharge is a relevant consideration in determining the extent and types of waste discharges that may have occurred from the 28th Street Shore Boat Landing Station to the Shipyard Sediment Site[80]. The Regional Board has considered evidence of past discharges from the U.S. Navy's former 28th Street Shore Boat Landing Station to the Shipyard Sediment Site by reviewing pollutant levels in core samples at depths that would reflect pollutant contributions during the years 1938 through 1956.

"Significance of Sediment Resuspension and Tidal Exchange to Reduction of Polychlorinated Biphenyl Mass in San Diego Bay" (Peng et. al. 2003) reports a sedimentation rate of 0.92 centimeters per year (cm/yr) at a sampling station in the vicinity of the Shipyard Sediment Site outside of the current leaseholds. The sedimentation rate may be higher within the leasehold closer to the shoreline since the currents may be less and the shoreline is nearer the source(s) of sediment input. Table 9-3 shows the estimated dates associated with the core depths for two different sedimentation rates. A sedimentation rate of 0.92 cm/yr suggests that the sediment in the 2 to 4 foot core were deposited prior to approximately 1936. Assuming a higher sedimentation rate of 2 cm/yr indicates that the sediment in the 2 to 4 foot core were deposited from approximately 1972 to 1942.

Table 9-3. Estimated Deposition Years for Cores Based on Sedimentation Rates

Core Depth	0.92 cm/year(1)	2 cm/year(2)
0 to 2 feet	2002 to 1936	2002 to 1972
2 to 4 feet	1936 to 1870	1972 to 1942
4 to 6 feet	1870 to 1804	1942 to 1912

(1) 0.92 cm/year corresponds to approximately 33 years per foot.
(2) 2 cm/year corresponds to approximately 15 years per foot.

79 See Regional Board Cleanup and Abatement Order Nos. 88-78, 88-79, 88-86, 89-31, and 89-32.

80 See section I.A.2. of Resolution 92-49.

The Shipyard Report provides analytic results from sediment cores collected down to depths of approximately 6 to 8 feet (Exponent, 2003). The results from Stations NA17 and NA19, the core locations closest to the former 28th Street Shore Boat Landing Station, are provided in Table 9-4.

The analytical results for tributyltin (TBT) were used to evaluate the applicability of the two deposition rates in Table 9-4. TBT was first used as a marine antifouling coating in the 1960s (GlobalSecurity.org, 2005). Therefore, TBT should not be reported in sediment deposited prior to the 1960s unless TBT in the overlying sediment contaminated the underlying sediment by mechanisms such as bioturbation or disturbances via propeller wash. Review of the core results indicate the presence of significant TBT levels in the cores collected from 2 to 4 feet in stations NA17 and NA19. The deposition rate of 0.92 cm/yr suggests that the sediment at 2 to 4 feet was deposited between 1936 and 1870. However the TBT concentrations suggest that the 2 to 4 ft. core interval includes sediment from the late 1960s or early 1970s (when TBT was first utilized), implying that the actual sedimentation rate was higher than 0.92 cm/year. A deposition rate of 2 cm/year indicates that the sediment in the core from 2 to 4 feet were deposited from 1942 to 1972. These dates are consistent with the presence of TBT in cores collected at the 2 to 4 ft. depth from stations NA17 and NA19 (see Table 9-4). Therefore, the higher deposition rate of 2 cm/year is judged to be more applicable to the Shipyard Sediment Site than the lower 0.92 cm/year rate.

Table 9-4. Selected Results from Core Stations NA17 and NA19

Depth	Contaminant	NA17	NA19
0 to 0.06 feet	PCB homologs µg/kg	620	1,400
0 to 2 feet	PCB homologs µg/kg	880	1,100
2 to 4 feet	PCB homologs µg/kg	720	1,100
4 to 5 feet	PCB homologs µg/kg	3.6	
4 to 6 feet	PCB homologs µg/kg		460
Sediment Cleanup Level[1] for PCBs is 420 µg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Benzo[a]pyrene µg/kg	370	-
0 to 2 feet	Benzo[a]pyrene µg/kg	640	440
2 to 4 feet	Benzo[a]pyrene µg/kg	240	330
4 to 5 feet	Benzo[a]pyrene µg/kg	19	
4 to 6 feet	Benzo[a]pyrene µg/kg		370
Sediment Cleanup Level[1] for BAP is 1,100 µg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Tributyltin µg/kg	1,400	570
0 to 2 feet	Tributyltin µg/kg	1,300	1,400
2 to 4 feet	Tributyltin µg/kg	340	120
4 to 5 feet	Tributyltin µg/kg	1.7	
4 to 6 feet	Tributyltin µg/kg		450
Sediment Cleanup Level[1] for tributyltin is 110 µg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Arsenic mg/kg	14	14
0 to 2 feet	Arsenic mg/kg	15	17
2 to 4 feet	Arsenic mg/kg	10	13
4 to 5 feet	Arsenic mg/kg	4	
4 to 6 feet	Arsenic mg/kg		4.5
Sediment Cleanup Level[1] for arsenic is 10 mg/kg			

[1] See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

Table 9-4. Selected Results from Core Stations NA17 and NA19, Continued

Depth	Contaminant	NA17	NA19
0 to 0.06 feet	Cadmium mg/kg	0.4	0.37
0 to 2 feet	Cadmium mg/kg	0.46	0.84
2 to 4 feet	Cadmium mg/kg	0.62	1.10
4 to 5 feet	Cadmium mg/kg	0.09	
4 to 6 feet	Cadmium mg/kg		0.78
Sediment Cleanup Level[1] for cadmium is 1.0 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Chromium mg/kg	74	65
0 to 2 feet	Chromium mg/kg	84	59
2 to 4 feet	Chromium mg/kg	24	31
4 to 5 feet	Chromium mg/kg	7.5	
4 to 6 feet	Chromium mg/kg		28
Sediment Cleanup Level[1] for chromium is 81 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Copper mg/kg	510	270
0 to 2 feet	Copper mg/kg	450	450
2 to 4 feet	Copper mg/kg	170	160
4 to 5 feet	Copper mg/kg	9	
4 to 6 feet	Copper mg/kg		71
Sediment Cleanup Level[1] for copper is 200 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Lead mg/kg	110	100
0 to 2 feet	Lead mg/kg	120	120
2 to 4 feet	Lead mg/kg	62	96
4 to 5 feet	Lead mg/kg	6.4	
4 to 6 feet	Lead mg/kg		35
Sediment Cleanup Level[1] for lead is 90 mg/kg			

[1] See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

Table 9-4. Selected Results from Core Stations NA17 and NA19, Continued

Depth	Contaminant	NA17	NA19
0 to 0.06 feet	Mercury mg/kg	0.84	0.78
0 to 2 feet	Mercury mg/kg	0.89	0.94
2 to 4 feet	Mercury mg/kg	0.39	0.60
4 to 5 feet	Mercury mg/kg	0.05	
4 to 6 feet	Mercury mg/kg		0.87
Sediment Cleanup Level[1] for mercury is 0.7 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Nickel mg/kg	17	17
0 to 2 feet	Nickel mg/kg	16	18
2 to 4 feet	Nickel mg/kg	8.1	9.9
4 to 5 feet	Nickel mg/kg	3.7	
4 to 6 feet	Nickel mg/kg		8.4
Sediment Cleanup Level[1] for nickel is 20 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Silver mg/kg	1.3	1.1
0 to 2 feet	Silver mg/kg	1.5	1.6
2 to 4 feet	Silver mg/kg	0.66	0.72
4 to 5 feet	Silver mg/kg	0.03	
4 to 6 feet	Silver mg/kg		0.81
Sediment Cleanup Level[1] for silver is 1.5 mg/kg			
Depth	**Contaminant**	**NA17**	**NA19**
0 to 0.06 feet	Zinc mg/kg	620	450
0 to 2 feet	Zinc mg/kg	550	850
2 to 4 feet	Zinc mg/kg	380	540
4 to 5 feet	Zinc mg/kg	24	
4 to 6 feet	Zinc mg/kg		210
Sediment Cleanup Level[1] for zinc is 300 mg/kg			

[1] See Sediment Cleanup Levels in Section 34, Finding 34: Alternative Cleanup Levels (Exponent, 2003)

There are uncertainties associated with this analysis. The estimated age associated with the core depths is dependent upon the sedimentation rate. There has been very little maintenance dredging reported at the Shipyard Sediment Site, which suggests that the deposition rate is low, in the order of 2 cm/year or less. Dredging was performed in 1981 for NASSCO's floating dry dock. However, the dredge footprint for NASSCO's floating drydock does not include the entire area occupied by the U.S. Navy on the northwest side of the 28th Street Pier, thus historical discharges to the Shipyard Sediment Site by the U.S. Navy were not removed by the dredging for the drydock.

Physical disturbances, such as bioturbation, dredging, and propeller wash, also introduce uncertainty into this interpretation. For example, if propeller wash from ship movements removes material from the bottom, the shallow sediment may be older than that indicated by applying the sedimentation rate. If disturbances result in redeposition of older sediment on top of newer sediment, the shallow sediment may be older than interpreted.

The Shipyard Report uses the presence of graded bedding in the sediment profiles to identify areas of no apparent physical disturbance. Stations NA17 and NA19 were reported to be stations with no apparent physical disturbance (Exponent, 2003). Therefore, assuming a deposition rate of 2 cm/year, it is likely that the pollutants reported in the sediment between 3 feet and 4.2 feet are from discharges between 1938 and 1956.

As indicated in Table 9-4, there are metals, PAHs, and PCBs above the tentative cleanup levels in the cores collected from 2 to 4 feet at stations NA17 and NA19. Therefore, it is likely that the pollutants reported in 2 to 4 foot cores at Stations NA17 and NA19 include discharges during the time of U.S. Navy operations at their 28th Street Shore Boat Landing Station.

9.4.2.1.3 <u>Lack of Documentation of Responsible Management of Materials and Waste</u>

According to the U.S. Navy's July 15, 2004 submittal to the Regional Board, information concerning industrial activities conducted by the U.S. Navy in the area of the NASSCO leasehold is limited (U.S. Navy, 2004):

> *"…but it is assumed that these shops maintained ship's launches and would manage materials similar in type to a small boatyard. Records related to activities at these shops are unavailable. A search for records concerning hazardous material usage, waste disposal and any releases that may have occurred in and around NASSCO were nonproductive. Records from the activities conducted by shops or ships docked at NASSCO shipyard have not been maintained."*

As stated in Section 9.2 "lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal" is relevant evidence which the Regional Board may consider in determining whether a party shall be required to clean up waste and abate the effects of discharge.

9.4.2.2 Other Records of Possible Known Discharge

Communications from NASSCO to the Regional Board indicate that ADFL-37 floating drydock was owned by the U.S. Navy and leased to NASSCO for a few years (Bermudez, 2005). As discussed in Section 9.4.2 the U.S. Navy reported that they "…were unable to find any records indicating the Navy operated a floating dry dock for painting and blasting operations" on the NASSCO leasehold. NASSCO did not submit any pertinent details on terms of the lease, the location of the floating dry dock on NASSCO's leasehold, the time period the floating drydock was in operation, or the role the U.S. Navy played in operating the floating dry dock. The U.S. Navy's alleged ownership of ADFL-37 floating drydock and the leasing of it to NASSCO for use in NASSCO's ship repair and construction activities does not constitute a sufficient basis to establish that the U.S. Navy caused or permitted the discharge of waste to the Shipyard Sediment Site.

9.5 Current Operations

NAVSTA San Diego is currently homeport for approximately 60 naval vessels and home base to 50 separate commands including major commands such as Fleet Training Center (FTC); Navy Public Works Center (PWC); Supervisor of Shipbuilding, Conversion, and Repair (SUPSHIP); Shore Intermediate Maintenance Activity (SIMA); and the Naval Supply Center (NSC). Each of these commands has specific and specialized fleet support purposes. NAVSTA San Diego is the workplace for approximately 48,000 military and civilian personnel.

NAVSTA San Diego currently occupies 1,029 acres of land and 326 water acres at the site lying east and west of Harbor Drive. The wetside consists of the San Diego Bay front area west of Harbor Drive in the City of San Diego. The dryside consists of the community facilities complex east of Harbor Drive.

9.5.1 Naval Station San Diego - Wetside

NAVSTA San Diego wetside located west of Harbor Drive is intensively developed and supports waterfront operations, ship berthing and maintenance, station maintenance, training, administration, and logistics functions. Operational facilities include piers, quay walls, a graving dock, small craft berthing facilities, fueling facilities, armories, and waterfront operations buildings. The straight-line map measurement of the shoreline at NAVSTA San Diego is approximately 1.6 miles. NAVSTA San Diego contains 13 berthing piers, a mole pier, two channels, one graving dock, one floating drydock, and various quay walls that have a total shoreline measurement of approximately 5.6 miles.

9.5.1.1 Piers

The 13 piers at NAVSTA San Diego are used to berth surface ships, support vessels, and barges. The surface ships, support vessels, and barges receive various ship support services such as supplies and minor repair or maintenance when berthed. Ship support services on the 13 piers include loading supplies and equipment onto the ships. Berth side ship repair and maintenance conducted while the vessel is docked at the pier may include abrasive blasting, hydro-blasting, metal grinding, painting, tank cleaning, removal of bilge and ballast water, removal of anti-fouling paint, sheet metal work, electrical work, mechanical repair, engine repair, hull repair, and sewage disposal. Berth side ship repair activities are generally less complex than the ship repair activities conducted at commercial shipyards or at the U.S. Navy's graving dock or floating drydock. Naval personnel (ships' force), civil service personnel, and civilian contractors conduct berth side maintenance. The diverse discharges from ship repair and maintenance activities could occur at several locations, including aboard ship when docked, on the piers, or on shore locations.

Ship repair activities may also be conducted on the piers. Boats, ship sections, or parts can be placed on the piers or adjacent lands for repairs. The ship repair activities may be conducted by U.S. Navy personnel (ships' force), civil service personnel, and civilian contractors. The breadth of work performed by the civilian contractors is typically greater than the work performed by ships' force. Most of the more complex ship repair work is conducted on ships berthed at Pier 13. Typically, civilian contractors will store materials and supplies on Pier 13 while working aboard the ship berthed at the Pier. However, ship repair activity is not limited to ships berthed at Pier 13. NAVSTA San Diego also has several SIMA repair shops at the facility. The SIMA repair shops conduct repairs on various parts of the vessels, such as antenna repair or mechanical repairs.

9.5.1.2 Graving Dock

The U.S. Navy Graving Dock facility occupies slightly more than six acres of land just south of Pier 5 at the NAVSTA San Diego. The facility is used for periodic maintenance and repair of U.S. Navy ships. The dock basin is approximately 700 feet long, 104 feet wide, and 42 feet deep and can accommodate vessels up to 688 feet long and 90 feet wide with a 30 foot draft. The U.S. Navy Graving Dock has an annual average of three ships in for repairs or maintenance. During ship repair operations, private contractors perform repair and overhaul work on vessels scheduled by the U.S. Navy, under contract to SUPSHIP. The industrial activity is limited to facility maintenance and vehicle parking when ship repair activity is not occurring. Operations at the U.S. Navy Graving Dock generate or have the potential to generate discharges of waste to San Diego Bay. The discharges may include industrial process water and/or storm water contaminated with abrasive blast material, paint, oils, lubricants, fuels, or solvents.

9.5.1.3 Other Land Parcels

Two land parcels within the NAVSTA San Diego perimeter are not under the control of NAVSTA San Diego. A 25.8-acre compound is owned by Naval Supply Center, and 40 acres of railroad right-of-way is owned by the Atchison, Topeka & Santa Fe Railroad (AT&SF) and the Metropolitan Transit Development Board (MTDB). Interstate 5, Harbor Drive, and various public utilities occupy 54.51 acres of NAVSTA San Diego real estate under easement or permit. There are no discharges reported as being associated with the land parcels not under the control of NAVSTA San Diego.

9.5.2 Naval Station San Diego - Dryside

NAVSTA San Diego dryside consists of the community facilities complex east of Harbor Drive. The MS4s east of Harbor Drive discharge into Chollas Creek. The entire watershed contributing to Chollas Creek drains a total of approximately 16,273 acres of land. The area of NAVSTA San Diego draining to Chollas Creek is approximately 266 acres. The U.S. Navy reports that there are at least 8 “non industrial” MS4 storm drains and 30 non industrial sheet flow discharge points that discharge urban runoff from NAVSTA San Diego – Dryside directly to Chollas Creek (Chichester, 2006).

9.6 U.S. Navy Discharged Waste to San Diego Bay in Violation of Waste Discharge Requirements

The U.S. Navy owns and operates a municipal separate storm water conveyance system (MS4) at NAVSTA San Diego through which it has caused or permitted the discharge of pollutants commonly found in urban runoff to Chollas Creek and San Diego Bay, including excessive concentrations of copper, lead, and zinc in violation of waste discharge requirements.

NAVSTA San Diego must obtain and comply with all terms of an NPDES Permit in order to lawfully discharge pollutants to surface waters. Any noncompliance of NPDES Permit requirements constitutes a violation of the Clean Water Act and California Water Code and is grounds for enforcement action, including the issuance of a cleanup and abatement order under the circumstances described in Water Code section 13304.

NAVSTA San Diego’s NPDES Permit requirement violations are documented in the Regional Board records via monitoring reports submitted during the years 1994 through 2005. U.S. Navy’s discharges of waste in violation of waste discharge requirements are presented below in Section 9.9 of this Technical Report.

9.7 U.S. Navy Discharged Waste to San Diego Bay Creating a Condition of Pollution, Contamination, and Nuisance Conditions in San Diego Bay

The U.S. Navy has caused or permitted discharges of pollutants from NAVSTA San Diego to San Diego Bay and has contributed to both the levels of pollutants, and the pollution and nuisance conditions, found at the Shipyard Sediment Site. Water Code section 13304 requires that a person who causes any waste to be discharged, or deposited where it probably will be discharged, into waters of the state creating, or threatening to create, a condition of pollution or nuisance is subject to cleaning up or abating the effects of the waste.

The Porter-Cologne Water Quality Act defines "pollution" as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects… …the waters for beneficial uses …"[81] "Contamination" is defined as "an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected."[82]

Pollutants generated at NAVSTA San Diego were discharged in storm water to San Diego Bay, transported via tides and ship movement, and discharged directly to the Shipyard Sediment Site from the 28th Street Shore Boat Landing Station as a result of U.S. Navy operations. The pollutants include metals, butyl tins, PCBs, PCTs, PAHs, and TPH. Many of these same pollutants are present in the marine sediment of the Shipyard Sediment Site in highly elevated concentrations as compared to sediment chemistry levels found at off-site reference stations located in areas of San Diego Bay[83].

Based on the evidence presented in Section 9.9, 9.10, and 9.11 of this Technical Report, the U.S. Navy has a history of discharging pollutants at levels that have contributed to a condition of pollution, contamination, or nuisance at the Shipyard Sediment Site. As described in Sections 12 through 29 of this Technical Report these same pollutants in the discharges have accumulated in San Diego Bay sediment at levels that:

1. Adversely affect the beneficial uses of San Diego Bay as described in later sections of this Technical Report, violating a NPDES requirement prohibitions pertaining to discharges that cause pollution, contamination, or nuisance conditions in San Diego Bay; and
2. Violate NPDES requirements pertaining to discharges that degrade marine communities, cause adverse effects on the environment or the public health, or result in harmful concentrations of pollutants in marine sediment.

[81] Water Code section 13050(1).

[82] Water Code section 13050(k).

[83] See Section 15 of this Technical Report.

Accordingly, it is concluded that the U.S. Navy has caused or permitted the discharge of waste to Chollas Creek and San Diego Bay in a manner causing the creation of pollution or nuisance conditions, that has contributed to both the levels of pollutants and the pollution and nuisance conditions found at the Shipyard Sediment Site through the pollutant transport pathways, and that it is appropriate for the Regional Board to issue a cleanup and abatement order naming the U.S. Navy as a discharger pursuant to Water Code section 13304.

Further discussion on pollution, contamination, and nuisance are available in Sections 1.4 and 1.5 of this Technical Report.

9.8 U.S. Navy NPDES Requirement Regulation

In 1992, NAVSTA San Diego obtained coverage under the State Water Resources Control Board's General Industrial Storm Water National Pollutant Discharge Elimination System (NPDES) Requirements for the discharge of industrial storm water. A listing of successive General Industrial Storm Water Permits adopted by the State Water Resources Control Board since 1991 and applicable to NAVATA San Diego industrial storm water discharges is provided in Table 9-5 below.

Table 9-5. NAVSTA San Diego's General Industrial Storm Water NPDES Requirements

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
91-13-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	November 19, 1991 (Notice of Intent Filed November 4, 1992)	April 17, 1997 (Notice of Intent Filed July 8, 1997)
97-03-DWQ, Industrial NPDES No. CAS000001	Waste Discharge Requirements (WDRs) For Discharge Of Storm Water Associated With Industrial Activities Excluding Construction Activities	April 17, 1997 (Notice of Intent Filed July 8, 1997)	(Notice of Termination Approved) November 13, 2002

The General Industrial Storm Water Permit required NAVSTA San Diego to develop and implement plans to limit its discharges of pollutants from storm water runoff into San Diego Bay. Rather than relying on specific numerical effluent limitations, the General Permit directed NAVSTA San Diego to create and follow "Best Management Practices"[84] (BMPs). The General Industrial Storm Water NPDES Requirements also required NAVSTA San Diego to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) and a storm water Monitoring and Reporting Program Plan (MRPP). The requirements specified that the SWPPP include, among other things, the following:

- Descriptions of sources that might add significant quantities of pollutants to storm water discharges;
- A detailed site map;
- Descriptions of materials that had been treated, stored, spilled, disposed of, or leaked into storm water discharges since November 1988;
- Descriptions of the management practices that were employed to minimize contact between storm water and pollutants from vehicles, equipment, and materials;
- Descriptions of existing structural and non-structural measures to reduce pollutants in storm water discharges;
- Descriptions of methods of on-site storage and disposal of significant materials;
- Descriptions of outdoor storage, manufacturing, and processing activities;
- A list of pollutants likely to be present in significant quantities in storm water discharges and an estimate of the annual amounts of those pollutants in storm water discharge;
- Records of significant leaks or spills of toxic or hazardous pollutants to storm water;
- A summary of existing data describing pollutants in storm water discharge;
- Descriptions of storm water management controls, including good housekeeping procedures, preventive maintenance, and measures to control and treat polluted storm water; and
- A list of the specific individuals responsible for developing and implementing the SWPPP.

[84] Best management practices (“BMPs”) means schedules of activities, prohibitions of maintenance procedures, and other management practices to prevent or reduce the pollution of “waters of the United States.” BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

NAVSTA San Diego developed the MRPP and has implemented it since 1994. NAVSTA San Diego's MRPP identified 56 outfalls as industrial storm water outfalls that discharge to San Diego Bay. Typically, less than half of the 56 outfalls were sampled during rain events, pursuant to the General Industrial Storm Water NPDES Requirements.

In 2002, the Regional Board issued Order No. R9-2002-0169, NPDES Permit No. CA0109169, *Waste Discharge Requirements For U. S. Navy, Naval Base San Diego (NBSD), San Diego County* (hereinafter NBSD NPDES Requirements or NBSD Permit). The NBSD NPDES Requirements regulates point source discharges from NAVSTA San Diego and three other San Diego naval installations.[85] The NBSD Permit incorporated and superseded the SWPPP and MRPP requirements of NAVSTA San Diego's previous General Industrial Storm Water NPDES Requirements. Order No. 2002-0169 currently regulates the following point source discharges from NAVSTA San Diego to San Diego Bay[86].

- Utility vault & manhole dewatering,
- Steam condensate,
- Salt water system discharge,
- Pier boom, mooring, and fender system cleaning,
- Miscellaneous discharges (landscape watering runoff, potable water & fire system maintenance),
- Ship repair and maintenance activities, and
- Industrial storm water.

Order No. 2002-0169 remains in effect as provided in Table 9-6 below.

[85] The Naval Base San Diego (NBSD) Complex includes four installations: (1)Naval Station, San Diego (NAVSTA); (2) Mission Gorge Recreational Facility (MGRF); (3) Broadway Complex; and (4) Naval Medical Center, San Diego (NMCSD).

[86] The following point source discharges from the NAVSTA San Diego Graving Dock facility are currently regulated under separate NPDES requirements contained in Order No. R9-2003-0265, *Waste Discharge Requirements for United States Navy Graving Dock Located at Naval Station San Diego, San Diego County*: (1) Saltwater supply system water, (2) Caisson gate ballast water, (3) Graving dock flood dewatering, (4) Ship repair and maintenance activities, and (5) Industrial storm water.

Table 9-6. NBSD NPDES Requirements

Order Number / NPDES No.	Order Title	Adoption Date	Expiration Date
R9-2002-0169, NPDES No. CA0109169	Waste Discharge Requirements For U.S. Navy, Naval Base San Diego, San Diego County	November 13, 2002	Present

Pursuant to the NBSD NPDES Requirements cited above, NAVSTA San Diego was required to develop and implement BMP plans to limit discharges of pollutants into San Diego Bay. As described in the NBSD NPDES requirements (Order No. R9-2002-0169), BMPs may be "structural" (e.g., tarpaulins and shrouds to enclose work areas, retention ponds, devices such as berms to channel water away from pollutant sources, and treatment facilities) or "non-structural" (e.g., good housekeeping, preventive maintenance, personnel training, inspections, and record-keeping).

9.8.1 Order No. 91-13-DWQ, NPDES Permit No. CAS000001, General Industrial NPDES Requirements for Storm Water Discharges

Order No. 91-13-DWQ, NPDES Permit No. CAS000001, in effect from November 4, 1992 to July 8, 1997 contained the following narrative limitations that relate to the discussions contained herein:

- A. DISCHARGE PROHIBITIONS … 3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance; and
- B. RECEIVING WATER LIMITATIONS … 1. Storm water discharges to any surface or ground water shall not adversely impact human health or the environment.
- B. RECEIVING WATER LIMITATIONS … 2. Storm water discharges shall not cause or contribute to a violation of any applicable water quality standards contained in the California Ocean Plan, Inland Surface Water Plan, Enclosed Bays and Estuaries Plan, or the applicable Regional Board’s Basin Plan.

9.8.2 Order No. 97-03-DWQ, NPDES Permit No. CAS000001, General Industrial NPDES Requirements for Storm Water Discharges

Order No. 97-03-DWQ, NPDES Permit No. CAS000001, in effect from July 8, 1997 to November 13, 2002 contained the following narrative limitations that relate to the discussions contained herein:

- A. DISCHARGE PROHIBITIONS … 3. Storm water discharges and authorized non-storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance; and
- C. RECEIVING WATER LIMITATIONS … 1. Storm water discharges and authorized non-storm water discharges to any surface or ground water shall not adversely impact human health or the environment.
- C. RECEIVING WATER LIMITATIONS … 2. Storm water discharges and authorized non-storm water discharges shall not cause or contribute to an exceedance of any applicable water quality standards contained in a Statewide Water Quality Control Plan or the applicable Regional Water Board's Basin Plan.

9.8.3 Order No. R9-2002-0169, Naval Base San Diego NPDES Permit No. CA0109169

Order No. R9-2002-0169, NPDES Permit No. CA0109169, in effect from November 13, 2002 to the present, contains the following narrative limitations that relate to the discussions contained herein:

- A. PROHIBITIONS … 5. Industrial storm water discharges and authorized or permitted non-storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance as defined in Water Code section 13050; and
- B. DISCHARGE SPECIFICATIONS … 1. The discharger shall not cause pollution, contamination, or nuisance, as those terms are defined in Water Code section 13050, as a result of the treatment or discharge of wastes; and
- C. RECEIVING WATER LIMITATIONS … 1. The discharge of wastes shall not cause or contribute to an exceedance of any applicable water quality objective or standards contained in a state Water Quality Control Plan, the California Toxics Rule, or the San Diego Basin Plan; and
- C. RECEIVING WATER LIMITATIONS … 2. Storm water discharges and authorized non-storm water discharges to any surface or ground water shall not adversely impact human health or the environment.

9.8.4 NAVSTA San Diego's Outfall Locations

NAVSTA San Diego's MRPP identified 56 outfalls as industrial storm water outfalls that discharge to San Diego Bay. Typically less than half of the 56 outfalls were monitored under the terms of the MRPP. Various outfalls were sampled over time, but in general, the twenty-one outfalls in Table 9-7 below were included:

Table 9-7. NAVSTA San Diego Outfall Locations

Industrial Storm Water Outfall	Location Description	Receiving Water
Outfall 5	24-inch diameter pipe west of Building 3116 between Pier 3 & Pier 4. A 12-inch diameter pipe is located about 4-feet above the outfall. Drainage area includes seven SIMA facilities[87], and machine shop.	San Diego Bay
Outfall 9	A 12-inch diameter pipe west of drydock 1. Drainage area includes four SIMA facilities and machine shop.	San Diego Bay
Outfall 11	24-inch diameter reinforced concrete pipe (RCP), near graving dock, west of Building 83. Drainage area includes three SIMA facilities and ship-to-shore utilities.	San Diego Bay
Outfall 14	30-inch diameter RCP west of Woden Street between Pier 6 and Pier 7. Drainage area includes warehouse and forklift and vehicle maintenance areas.	San Diego Bay
Outfall 22	18-inch diameter RCP east of Pier 7. Drainage area includes hazardous waste area.	San Diego Bay
Outfall 26	18-inch diameter RCP between Buildings 3322 and 68. Drainage area includes a formerly demolished industrial facility.	San Diego Bay
Outfall 30	18-inch diameter RCP between Cummings Road and Harbor Drive. Drainage area includes a diesel and gas fueling station.	Paleta Creek
Outfall 33	18-inch diameter RCP northeast of Building 197. Drainage area includes Pier #9 (Mole pier) with activities including sandblasting and painting.	San Diego Bay
Outfall 35	18-inch RCP west of 7th Street. Drainage area includes a roofing shop and areas with activities including sandblasting and painting.	San Diego Bay
Outfall 36	18-inch RCP at Paleta Creek Channel quay wall, north of Building 199.	Paleta Creek

[87] SIMA facilities may include the following: Production Facility, Engine Shop, Machine/Welding Shop, two-Maintenance Shops, Auxiliary Machine shop, Machine shop, Maintenance, Auxiliary Machine, Transportation and Maintenance, and Maintenance, Sheet Metal Shop/Corrosion, Antenna Repair Shop.

Industrial Storm Water Outfall	Location Description	Receiving Water
Outfall 39	24-inch RCP at Pier 9 (Mole Pier) Drainage area includes activities including sandblasting and painting.	San Diego Bay
Outfall 45	18-inch diameter RCP, northwest of Building 335, between Pier 9 and Pier 10. Drainage area includes consolidated diver's unit and hazardous material reutilization area	San Diego Bay
Outfall 46	18-inch diameter RCP adjacent to Pier #10, southeast of 10th Street. Drainage area includes garbage cooker area, truck wash and storage yard, crane, rigging and construction area, shop storage, and shop stores.	San Diego Bay
Outfall 71	Swale at curb, northwest corner of 32nd Street and Norman Scott Road intersection. Drains directly into Chollas Creek. Drainage area includes Navy exchange, gasoline station and auto care center.	Chollas Creek
Outfall 78	30-inch diameter RCP at Paleta Creek, just east of SD Trolley bridge. Drainage area includes auto hobby shop and carports, Fleet Training Center and Fire Fighting School.	Paleta Creek
Outfall 80	42-inch diameter RCP at Paleta Creek just east of Atchinson Topeka and Santa Fe RR bridge. Drainage area includes garbage cooker area, truck wash and storage yard; diesel & gasoline fuel station; shop stores; recycling center; contractor storage site; crane and rigging area.	Paleta Creek
Outfall 99	12-inch diameter PVC pipe in Chollas Channel quay wall south of Building 185A. Drains directly into Chollas Creek. Drainage area includes former hazardous material storage facility (facility has been demolished).	Chollas Creek
Outfall 119	Two-foot wide asphalt/dirt swale, northwest corner of boat yard/storage area. Drainage area includes a scrap yard.	San Diego Bay
Outfalls 161-171	Pier 1—multiple discharge points. Pier #1 is located immediately adjacent to the area where Chollas Creek discharges into San Diego Bay. Drainage area includes Pier 1.	San Diego Bay
Outfalls 172-195	Pier 2—multiple discharge points. Drainage area includes Pier 2.	San Diego Bay
Outfalls 415-438	Pier 13—multiple discharge points. Drainage area includes Pier 13.	San Diego Bay

It is important to note that Outfall 71 and Outfall 99 discharge directly into Chollas Creek and that Outfalls 161 through 171 are located on Pier 1 which is immediately adjacent to the area where Chollas Creek discharges into San Diego Bay. Available U.S. Navy studies (Katz et al., 2003; Chadwick et al., 1999) indicate that pollutants from Chollas Creek outflows, and from NAVSTA San Diego in general (including resuspended sediment), can be conveyed to the Shipyard Sediment Site via storm water flows, tidal currents, and ship movements. (See Section 9.11 for a detailed discussion of these pollutant discharge pathways)

9.9 U.S. Navy Discharges Associated with Current Operations

9.9.1 Storm Water Monitoring for General Industrial NPDES Requirements for Storm Water Discharges and NBSD NPDES Requirements

Since 1992, General Industrial Storm Water NPDES Requirements have included Discharge Prohibitions and Receiving Water Limitations that set a narrative limit on discharge pollutant concentrations with the intent to reduce or eliminate toxic chemical concentrations in marine water, marine life, and sediment.

While subject to regulation under the General Industrial Storm Water NPDES Requirements, NAVSTA San Diego discharged pollutants at levels that are elevated compared to levels established by the California Toxics Rule (CTR) for saltwater.[88] The U.S. EPA finalized the CTR on May 18, 2000. None of the numerical values in CTR were included as numerical effluent limitations in any of the General Industrial NPDES Requirements issued to NAVSTA San Diego before May 2000; however, they are included as a narrative receiving water limitation in the current NBSD NPDES Requirements issued in 2002.

The numerical values in CTR represent the latest, most up-to-date numerical thresholds for use in determining whether a chemical concentration in a water body is detrimental to its beneficial uses. By comparing CTR values with pollutant levels in historical discharges, the Regional Board can determine which discharges *may* have contributed to toxic chemical concentrations in marine water, marine life, and sediment at the Shipyard Sediment Site in the past. Also, where there were historical discharges that were elevated above CTR values, there exists an *elevated probability* that those same discharges contributed to the present condition of pollution. In retrospect, to the extent that those historical, elevated discharges *did* cause toxic chemical concentrations in marine water, marine life, and sediment, and/or *did* contribute to the present condition of pollution at the Shipyard Sediment Site, there exists an NPDES requirement violation.

[88] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

Monitoring reports submitted by NAVSTA San Diego during the years 1994 through 2005, pursuant to the General Industrial Storm Water NPDES Requirements and NBSD NPDES Requirements, indicate that elevated levels of several pollutants, including but not limited to copper and zinc, were present in storm water discharged from the NAVSTA San Diego facility to San Diego Bay. As an example of these pollutant discharges, specific discharge violations of copper and zinc are listed below.

9.9.1.1 Storm Water Monitoring for General Industrial NPDES Requirements for Storm Water Discharges

NAVSTA San Diego obtained coverage under the State Water Resources Control Board's General Industrial Storm Water National Pollutant Discharge Elimination System (NPDES) Requirements for the discharge of industrial storm water. Order No. 91-13-DWQ, NPDES Permit No. CAS000001 was in effect from November 4, 1992 to July 8, 1997. Order No. 97-03-DWQ, NPDES Permit No. CAS000001, was in effect from July 8, 1997 to November 13, 2002.

While not providing specific numerical effluent limitations for all possible chemicals, the Regional Board did require that discharges from NAVSTA San Diego not cause a violation of the discharge prohibitions and receiving water limitations presented in Section 9.8, above. NPDES discharge monitoring data provided by NAVSTA San Diego from 1992 through 1997 and 1998 through 2002 indicate elevated levels of discharged pollutants, including but not limited to copper and zinc, when compared to levels established by the CTR for saltwater.

To the extent that NAVSTA San Diego's discharges were elevated above CTR criteria values and violated General Industrial Storm Water NPDES requirement discharge prohibitions and receiving water limitations by causing toxic chemical concentrations in marine water, marine life, and sediment, and/or contributed to the present condition of pollution at the Shipyard Sediment Site (via storm flows, tidal movements (see Section 9.11), the following specific discharges are a violation of narrative limits of Order No. 91-13-DWQ, NPDES Permit No. CAS000001, and Order No. 97-03-DWQ, NPDES Permit No. CAS000001, and are cited in Tables 9-8 and 9-9[89] below.

[89] On October 30, 2000, the U.S. EPA promulgated FR Vol. 65, No. 210, U.S. EPA Benchmark Values for pollutant discharge from industrial facilities. The U.S. EPA Benchmark Values for copper and zinc are 0.0636 mg/L and 0.117 mg/L, respectively. While the U.S. EPA Benchmark Values are not an enforceable numeric limit, they are used to indicate concentrations of concern and to alert the regulated discharger to take actions to lower the concentrations in its discharge. Some sample concentrations in this table, dated after October 30, 2000, exceed both CTR and U.S. EPA Benchmark Values for copper and zinc.

Table 9-8. Discharges above CTR Criteria Values Occurring from 1992 to 1997

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Copper	0.092 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.088 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.97 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.67 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.028 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Copper	0.043 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Copper	0.24 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	0.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	0.63 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	0.39 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	2.6 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	1.5 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 17, 1994	Zinc	0.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	1.0 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 17, 1994	Zinc	0.5 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1994 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 1995	Copper	0.019 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 1995	Zinc	0.27 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.0082 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.028 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 5, 1995	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.17 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.046 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.075 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.012 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Copper	0.09 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 5, 1995	Zinc	0.14 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.21 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.5 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.41 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.32 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.77 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.37 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 5, 1995	Zinc	0.07 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 5, 1995	Zinc	0.24 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 11, 1995	Copper	0.014 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 11, 1995	Copper	0.034 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 11, 1995	Copper	0.032 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 11, 1995	Zinc	0.31 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 11, 1995	Zinc	0.15 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 18, 1995	Copper	0.049 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.061 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.0014 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.59 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.57 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.2 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 18, 1995	Copper	0.028 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.03 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.072 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.031 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.37 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 419	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Copper	0.45 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 429	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 18, 1995	Copper	0.066 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 433	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.25 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.32 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.068 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	1.6 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	1.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.64 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 18, 1995	Zinc	0.59 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.15 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.23 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.29 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 18, 1995	Zinc	0.12 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1995 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.08 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 09, 1996	Copper	0.254 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.04 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.096 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.138 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.354 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.864 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	1.68 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 09, 1996	Copper	0.142 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.41 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.173 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Copper	0.052 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 429	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.43 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.984 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.17 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
December 09, 1996	Zinc	0.858 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.52 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	1.68 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	1.58 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.501 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	1.79 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
December 09, 1996	Zinc	0.523 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 15, 1997	Copper	0.0402 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.0378 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.0337 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.0239 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.104 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.115 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	1.02 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 15, 1997	Copper	1.29 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.262 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.0426 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.485 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.28 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.324 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Copper	0.0754 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 429	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 15, 1997	Zinc	0.146 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.233 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.173 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.178 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.323 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	1.41 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	2.82 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 15, 1997	Zinc	0.743 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.134 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.134 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	1.7 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 15, 1997	Zinc	0.741 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.569 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.0883 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 1997	Copper	0.0569 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Copper	0.4 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.198 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.429 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.323 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 1997	Zinc	0.323 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1997 Annual Report	Order No. 91-13-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

[1] 40 CFR 131.38

[2] Reference to Section 9.6 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 9.7 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 9.6 and 9.7.

[3] The cited waste discharge requirement(s) can be found in Section 9.8 of this Technical Report.

Table 9-9. Discharges above CTR Criteria Values Occurring from 1998 to 2002

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Copper	0.13 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.14 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.07 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.02 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.09 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.03 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.86 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.41 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.18 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.08 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.06 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Copper	0.10 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.56 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	1.01 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.45 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.81 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.34 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Zinc	1.16 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	1.12 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.47 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.48 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.46 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.74 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.64 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 8, 1998	Zinc	0.75 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 8, 1998	Zinc	0.23 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.075 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.072 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.03 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1999	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.06 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.30 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.95 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.068 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.055 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.033 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1999	Copper	0.122 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Copper	0.28 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.29 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.19 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.72 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.43 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.33 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1999	Zinc	0.70 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	1.97 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.266 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.107 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.28 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 4, 1999	Zinc	0.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 4, 1999	Zinc	0.36 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1998-1999 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.123 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.0716 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.0962 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.185 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.186 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.290 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2000	Copper	0.551 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.927 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.0688 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.123 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.107 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Copper	0.182 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	0.925 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2000	Zinc	0.501 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	1.27 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	0.511 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	1.23 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	1.06 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	0.306 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	0.861 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2000	Zinc	0.146 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 10, 2000	Zinc	0.762 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 12, 2000	Copper	0.0201 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 12, 2000	Copper	0.0088 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 12, 2000	Copper	0.0909 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 12, 2000	Zinc	0.631 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 12, 2000	Zinc	0.021 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 12, 2000	Zinc	0.577 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
February 20, 2000	Copper	0.118 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0363 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0279 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0189 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0527 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0603 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2000	Copper	0.0778 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.314 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.17 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0696 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0398 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0291 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0762 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2000	Copper	0.0371 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0591 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Copper	0.0419 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.278 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.412 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.123 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.14 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2000	Zinc	0.189 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.096 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.163 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.119 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.295 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.168 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 17, 2000	Zinc	0.216 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 99	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2000	Zinc	0.191 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 21, 2000	Copper	0.0085 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 21, 2000	Zinc	0.0154 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 1999-2000 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.38 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.0218 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.163 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.243 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 27, 2000	Copper	0.413 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	1.18 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.261 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.125 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.0704 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.0591 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.138 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 27, 2000	Copper	0.125 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.0801 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.117 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Copper	0.32 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	2.34 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.456 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.863 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 27, 2000	Zinc	1.85 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	1.55 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	2.15 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	1.96 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.504 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.402 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.608 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
October 27, 2000	Zinc	0.669 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.504 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.233 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	0.410 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
October 27, 2000	Zinc	1.79 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.193 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.139 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 8, 2001	Copper	0.118 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.143 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.646 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.117 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.255 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.266 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.282 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 8, 2001	Copper	0.119 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.19 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	1.67 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.235 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.184 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Copper	0.234 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.561 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 8, 2001	Zinc	0.695 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.283 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	1.49 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	2.91 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	1.55 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 26	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.697 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.51 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 8, 2001	Zinc	0.856 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.274 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.449 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	7.83 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	1.04 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.422 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 8, 2001	Zinc	0.642 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 24, 2001	Copper	0.0461 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.0555 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.0742 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.0742 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.293 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.881 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.121 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 24, 2001	Copper	0.0999 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.134 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Copper	0.282 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.249 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.356 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.316 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	1.06 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 24, 2001	Zinc	1.17 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	2.06 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.675 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.451 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.629 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
January 24, 2001	Zinc	0.856 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2000-2001 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0844 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 24, 2001	Copper	0.0816 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0537 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.287 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0177 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 24	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.047 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0803 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0857 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 24, 2001	Copper	0.0641 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0569 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0479 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.113 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.124 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0795 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.0398 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 24, 2001	Copper	0.0808 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Copper	0.151 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.553 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.639 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.813 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	1.27 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.14 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 24	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 24, 2001	Zinc	0.194 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.0776 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.423 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.278 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.320 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.578 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 24, 2001	Zinc	0.622 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.134 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.0807 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.816 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 24, 2001	Zinc	0.478 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 29, 2001	Copper	0.0566 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 29, 2001	Copper	0.0569 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
November 29, 2001	Zinc	0.809 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
November 29, 2001	Zinc	0.453 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 7, 2002	Copper	0.209 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 7, 2002	Copper	0.310 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 7, 2002	Zinc	1.41 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 71	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
March 7, 2002	Zinc	2.33 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 78	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.234 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 24, 2002	Copper	0.117 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.206 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.299 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.0283 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 24	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.166 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.454 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.604 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 24, 2002	Copper	0.552 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.289 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.145 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.2 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.0685 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.0628 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Copper	0.195 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 24, 2002	Zinc	1.23 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	2.95 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	3.7 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	1.48 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	0.175 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 24	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	1.03 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 33	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	0.877 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 24, 2002	Zinc	0.755 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 36	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	3.04 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	1.51 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	0.704 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	1.49 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	0.202 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1
April 24, 2002	Zinc	0.332 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 24, 2002	Zinc	0.47 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2001-2002 Annual Report	Order No. 97-03-DWQ, A. Discharge Prohibitions 3 and B. Receiving Water Limitations 1

[1] 40 CFR 131.38

[2] Reference to Section 9.6 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 9.7 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 9.6 and 9.7.

[3] The cited waste discharge requirement(s) can be found in Section 9.8 of this Technical Report.

9.9.1.2 Storm Water Monitoring for NAVSTA San Diego, Naval Base San Diego NPDES Requirements

The Naval Base San Diego (NBSD) NPDES Requirements regulate point source discharges from NAVSTA San Diego and three other San Diego naval installations[90] in San Diego. Order No. R9-2002-0169, NPDES Permit No. CA0109169, is in effect from November 13, 2002 to the present.

While not providing specific numerical effluent limitations for all possible chemicals, the Regional Board did require that discharges from NAVSTA San Diego not cause a violation of the above discharge prohibitions and receiving water limitations, which specifically referred to the CTR. NPDES discharge monitoring data provided by NAVSTA San Diego in 2003 through 2005 indicate elevated levels of discharged pollutants, including but not limited to copper and zinc, when compared to levels established by the CTR for saltwater.

To the extent that NAVSTA San Diego's discharges were elevated above the CTR criteria values and violated NBSD NPDES requirement discharge prohibitions and receiving water limitations by causing toxic chemical concentrations in marine water, marine life, and sediment, and/or contributed to the present condition of pollution at the Shipyard Sediment Site via storm flows, tidal movements, or other transport mechanisms (please see Section 9.11), the following specific discharges are a violation of narrative limits of Order No. R9-2002-0169, NPDES Permit No. CA0109169, and are cited in Table 9-10[91] below.

[90] The Naval Base San Diego (NBSD) Complex includes four installations: (1)Naval Station, San Diego (NAVSTA); (2) Mission Gorge Recreational Facility (MGRF); (3) Broadway Complex; and (4) Naval Medical Center, San Diego (NMCSD).

[91] On October 30, 2000, the U.S. EPA promulgated FR Vol. 65, No. 210, U.S. EPA Benchmark Values for pollutant discharge from industrial facilities. The U.S. EPA Benchmark Values for copper and zinc are 0.0636 mg/L and 0.117 mg/L, respectively. While the U.S. EPA Benchmark Values are not an enforceable numeric limit, they are used to indicate concentrations of concern and to alert the regulated discharger to take actions to lower the concentrations in its discharge. Some sample concentrations in this table, dated after October 30, 2000, exceed both CTR and U.S. EPA Benchmark Values for copper and zinc.

Table 9-10. Discharges above CTR Values Occurring from 2003 to 2005

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 15, 2003	Copper	0.150 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.091 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.014 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.012 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.19 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.15 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 15, 2003	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.48 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.28 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.042 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.12 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.072 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 15, 2003	Copper	0.13 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Copper	0.46 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.330 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.34 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.086 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 15, 2003	Zinc	0.1 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	1.1 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.5 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.18 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	2.6 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.49 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 15, 2003	Zinc	0.1 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.45 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.36 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.45 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 15, 2003	Zinc	0.95 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2002-2003 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 2004	Copper	0.083 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.029 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.064 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.032 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.067 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.1 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 2004	Copper	0.057 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.047 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.047 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.082 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Copper	0.12 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 2004	Zinc	0.38 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.16 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.42 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.55 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.29 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.25 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 18, 2004	Zinc	0.28 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.47 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.47 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.24 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 18, 2004	Zinc	0.36 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 1, 2004	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 1, 2004	Copper	0.046 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 1, 2004	Zinc	0.45 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 1, 2004	Zinc	0.17 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.210 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2004	Copper	0.12 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.092 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.11 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.27 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.19 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.12 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2004	Copper	0.056 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.17 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.26 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.065 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Copper	0.093 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2004	Zinc	0.69 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	4.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.7 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	1.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	1.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.6 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2004	Zinc	1.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.99 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.42 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.81 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.33 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.72 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
April 17, 2004	Zinc	0.51 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
April 17, 2004	Zinc	0.34 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2003-2004 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.039 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.056 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.0084 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.011 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 28, 2005	Copper	0.026 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.029 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.055 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.16 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.027 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.03 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 28, 2005	Copper	0.099 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.049 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.062 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.03 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Copper	0.14 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.21 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 28, 2005	Zinc	0.43 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.032 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.045 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.21 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.098 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.16 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 28, 2005	Zinc	0.56 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.16 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.49 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.13 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	2.2 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
January 28, 2005	Zinc	0.28 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
January 28, 2005	Zinc	0.68 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.018 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.037 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.12 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 35	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.028 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2005	Copper	0.029 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.07 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.039 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Copper	0.2 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.56 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 22	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2005	Zinc	0.27 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 30	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 35	2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.18 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 39	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.15 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 46	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.23 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 80	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	0.15 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 119	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 10, 2005	Zinc	1.5 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 167-171	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 10, 2005	Zinc	1.4 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 415-438	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 11, 2005	Copper	0.016 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 11, 2005	Copper	0.044 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 11, 2005	Copper	0.032 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 11, 2005	Zinc	0.16 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 14	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
February 11, 2005	Zinc	0.13 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 45	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
February 11, 2005	Zinc	0.3 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 172-195	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 4, 2005	Copper	0.072 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 4, 2005	Copper	0.05 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 4, 2005	Copper	0.08 mg/L	0.0031 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 4, 2005	Zinc	0.32 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 5	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

Date	Constituent	Concentration	CTR Saltwater Criteria (Continuous Concentration)[1]	Technical Report Reference[2]	Discharge Source	Source	Citation[3]
March 4, 2005	Zinc	0.52 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 9	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2
March 4, 2005	Zinc	0.34 mg/L	0.081 mg/L	Sections 9.6 and 9.7	Outfall 11	U.S. Navy 2004-2005 Annual Report	Order No. R9-2002-0169, A. Prohibitions 5, B Discharge Specifications 1, C. Receiving Water Limitations 1 and 2

[1] 40 CFR 131.38

[2] Reference to Section 9.6 indicates a discharge of waste in violation of waste discharge requirements. Reference to Section 9.7 indicates discharging or depositing waste where it will be discharged into San Diego Bay creating, or threatening to create a condition of pollution, contamination, and nuisance. See Sections 9.6 and 9.7.

[3] The cited waste discharge requirement(s) can be found in Section 9.8 of this Technical Report.

9.9.2 NAVSTA San Diego Storm Water Discharges to Chollas Creek[92]

Chollas Creek drains a total of approximately 16,273 acres of land. The area of NAVSTA San Diego draining to Chollas Creek is approximately 266 acres. Table 9-11 provides a statistical summary of U.S. Navy monitoring of U.S. Navy owned storm water outfalls discharging into Chollas Creek between the years 1994 through 2000. The data in Table 9-11 indicates that elevated levels of copper, lead, and zinc were almost always detected in the U.S. Navy's Chollas Creek storm water discharges between the years 1994 through 2000. Zinc was detected on all occasions while copper was detected 94 percent of the time and lead 91 percent of the time. Cadmium, chromium and nickel were also detected approximately 65% of the time.

[92] Unless otherwise explicitly stated, the data and technical information contained in this section were obtained from the U.S. Navy August 2000 Report, *Toxic Hot Spot Assessment Stud at Chollas Creek and Paleta Creek, Historical Data Review.* (U.S. Navy 2000)

Table 9-11. Statistical Summary of U.S. Navy Storm Water Monitoring for Chollas Creek Storm Drain Outfalls (1994 through 2000)

Parameter Total Metal	Geometric Mean Concentration (µg/L)	Arithmetic Mean Concentration (µg/L)	Number of Records (n=)	Standard Deviation	Range (µg/L)	Sample Dates	Number of Non-Detects	Method Detection Ranges (µg/L)
Arsenic	4.3	4.8	25	3	3 – 10	1994 – 1997	25	3 – 10
Cadmium	0.8	1.2	38	1	0.2 – 3.7	1994 – 1997	13	0.2 – 1.0
Chromium	8.8	13.1	41	10	1.3 – 50	1994 – 1999	13	1.5 – 20
Copper	**88.0**	**166.3**	**54**	**239**	**8.8 – 1,080**	**1994 – 2000**	**3**	**5 – 10**
Lead	**15.7**	**29.6**	**44**	**30**	**2 – 110**	**1994 – 2000**	**4**	**2.0 – 20**
Mercury	0.4	0.4	25	0.1	0.2 – 0.4	1994 – 1997	25	0.2 – 0.5
Nickel	18.4	23.7	32	16	4.8 – 63	1994 – 1997	11	5 – 40
Selenium	4.6	5.0	25	3	4 – 21	1994 – 1997	24	4 – 5
Silver	6.7	8.4	26	3	0.2 – 10	1994 – 1997	26	0.2 – 10
Zinc	**386**	**708**	**48**	**946**	**21 – 4,880**	**1994 – 2000**	**0**	**Unknown**

(U.S. Navy, 2000)

Leaching from U.S. Navy ship hull antifouling paint and cathodic protection systems provide continuing sources of copper and zinc to San Diego Bay waters at the mouth of Chollas Creek. The U.S. Navy has estimated loading rates from service craft and active military vessels typically moored in or near Chollas Creek waters, in an area bounded by Chollas Creek mooring locations and the south side of Pier 1. At the time of the study in 2000, seven commercial tugs and six U.S. Navy barges were typically berthed in Chollas Creek waters. One vessel, the USNS Mercy, was berthed for prolonged periods on the south side of Pier 1[93]. The U.S. Navy's copper and zinc loading estimates by vessel type are provided in Table 9-12. Total copper loading to the mouth of Chollas Creek area from ship hull antifouling paints was estimated at 220 kg/yr based on a conservative copper leach rate of 11 μg /cm^2/day[94]. Total zinc loading from leaching anodes associated with ship hull cathodic protection systems was estimated to be 508 kg/year using U.S. EPA estimated leach rates for the vessel types shown in Table 9-12 below.

Table 9-12. Estimated Copper and Zinc Loading from Service Craft and Active Military Vessels at Chollas Creek

Chollas Creek Service Craft	Number of Vessels	Copper Load (kg/yr)	Zinc Load (kg/yr)
Tiger FOSS commercial tug	1	9.9	22
Tractor commercial tug	6	59.4	132
Open Lighter YC1469 class (110x8x694)	6	101.4	354
USNS Mercy	1	49.0	-
Water Column Total (kg/yr):		**220**	**508**

Note: The values represent total loading to the water column. (U.S. Navy, 2000)

[93] Berthing of larger naval vessels (e.g. cruisers or destroyers) may sometimes occur at Pier 1. The operational berthing of these vessels at Pier 1 was not determined at the time the US Navy prepared its loading estimates. (U.S. Navy, 2000)

[94] Hull bottom leach rate determination is the subject of on-going research and can be influenced by paint age, cleaning frequency, water temperature and formation of surface algal film. As such the 11 ug /cm^2/day is a conservative estimate as there are some unpublished experimental data that suggest the true leach rate is likely lower. (U.S. Navy, 2000)

The U.S. Navy also estimated loading from U.S. Navy storm water outfalls and upstream urban storm water outfalls[95] to the mouth of Chollas Creek. The U.S. Navy's loading estimates for storm water and hull leachate are provided in Table 9-13 below.

Table 9-13. Estimated Annual Contaminant Loading to the Chollas Creek Toxic Hot Spot Region with Storm Water Inputs Listed by U.S. Navy and Upstream Portions of the Chollas Creek Watershed

	Size Acres	Copper kg/yr	Lead kg/yr	Mercury kg/yr	Zinc kg/yr	PAH total kg/yr	PCB total kg/yr
NAVSTA Chollas Creek Storm Water	209	16	3	0	71	-	-
Upstream Chollas Creek Storm Water	16,064	186	139	0	1,526	-	58
Hull Leachate	n/a	110	n/a	n/a	259	n/a	n/a
Total	**16,273**	**312**	**142**	**0**	**1,856**	**-**	**58**

Notes: Simple method used to calculate loading. EMC data by land use category available for copper, lead, and zinc. All others used storm water averages reported in this document assuming annual rainfall of 10.2 inches (1960-2000 average rainfall at Lindbergh Field, San Diego).

Dash (-) represents data not available to calculate loading at this time, typically due to unavailability of monitoring data.

Underlined = Data below method detection limit (DL) so conservatively used average DL as estimate of concentration. This makes loading estimates highly subjective, at best.

(U.S. Navy, 2000)

The U.S. Navy's loading estimates in Table 9-13, above, indicate that storm water is an ongoing major contributor of copper, lead, and zinc to the mouth of Chollas Creek. The data suggests that that the primary loading of copper, lead, and zinc is from the urban upstream portion of the Chollas Creek watershed. U.S. Navy storm water outfalls were estimated to introduce 5% of the cooper, 2% of the lead and 4% of the zinc. However, leaching of copper from U.S. Navy ship hull coatings was estimated to be 35% of the copper load and leaching of zinc from U.S. Navy cathodic protection system anodes was estimated to be 14% of the load. In summary, the U.S. Navy's pollutant contributions to the mouth of Chollas Creek, including storm water discharges, hull leaching, and

[95] The upstream storm water outfalls are primarily owned and operated by the City of San Diego. The City of San Diego owns and operates approximately 816 MS4 storm drain outfalls, which convey urban runoff into Chollas Creek.

cathodic protection account for approximately 40% of the copper load, 2% of the lead load, and 18% of the zinc load.

9.9.3 NAVSTA San Diego Pier Pilings

The outcome of various U.S. Navy environmental studies in San Diego Bay during the early 1990s suggests that there was a substantial chronic source of PAHs to San Diego Bay and that the hydrocarbons were predominately derived from a pyrogenic heat-producing source (Chadwick et al., 1999). The studies concluded that creosote treated[96] pilings were potentially a significant source of PAHs discharges to San Diego Bay due to the large number of such pilings in the Bay at the time the studies were conducted. The flux of PAHs from in-place creosote pilings was determined to be 0.0022 to 0.0033 $g \cdot cm^{-2} \cdot yr$. The total number of creosote pilings in San Diego Bay in 1995 was estimated by visual count at 13,600 pilings. Up until 1996, approximately 8,700 pilings (64%) were located mostly south of Coronado Bridge in the back bay, and of these, approximately 4,460 pilings were located in the vicinity of NAVSTA San Diego. Since 1996 approximately 50 percent of the pilings in the back bay have been replaced, leaving 2,230 in the vicinity of NAVSTA San Diego, 4,350 in the back bay as a whole, and 9,250 throughout the entire bay. Assuming a flux of 0.0022 to 0.0033 $g \cdot cm^{-2} \cdot yr$, Chadwick et al. (1999) determined the total historical contribution of PAHS to San Diego Bay prior to 1996 from creosote pilings to be 3.1 to 4.6 metric tons per year. The total “current” contribution of PAHS to San Diego Bay from the remaining creosote pilings in San Diego Bay in 2001 was estimated to be 2.1 to 3.1 metric tons per year. Since 1996, the U.S. Navy has been replacing creosote pier pilings at NAVSTA San Diego with plastic pilings and this effort is continuing.

9.10 Clean Water Act Section 303(d) Listed Impaired Waters Adjacent to NAVSTA San Diego

Data collected for the Bay Protection Toxic Cleanup Program (Fairey et al., 1996) were used to place portions of San Diego Bay on the CWA section 303(d) List. Three segments of the San Diego Bay shoreline adjacent to the NAVSTA San Diego were listed for sediment toxicity and benthic community degradation: Mouth of Chollas Creek, Mouth of Paleta Creek, and NAVSTA San Diego at 32nd Street. Historical and recent discharges from NAVSTA San Diego as well as other upstream urban sources in the Chollas Creek and Paleta Creek watersheds have contributed to pollutant levels found at these sites. The study, titled “Sediment Assessment Study for Mouths of Chollas and Paleta Creeks, San Diego, Phase I” (SCCWRP and U.S. Navy, 2005b) defined potential impairments for these two segments. In addition, the Shipyard Sediment Site is listed on the CWA section 303(d) List as San Diego Bay Shoreline, between Sampson and 28th Streets[97].

[96] At the time the studies were conducted, creosote was extensively used in the treatment of wood products exposed to the marine environment to minimize wood degradation.

[97] Final 2002 Clean Water Act Section 303(d) List of Water Quality Impaired Segments, approved by U.S. EPA in July 2003. http://www.waterboards.ca.gov/tmdl/docs/2002reg9303dlist.pdf

9.10.1 Mouth of Chollas Creek

The location for the CWA 303(d) listing of San Diego Bay Shoreline at the mouth of Chollas Creek extends from the weir downstream of the Belt Street Bridge, bounded on the north by the NASSCO pier and to the south by the NAVSTA San Diego Pier 1, and extends to the end of the piers. The estimated total area is 15 acres.

The Phase I Study, (SCCWRP and U.S. Navy, 2005b) reported that PAHs, PCBs, chlordane, and DDT concentrations indicated potential impairment to aquatic life, while copper concentration was specified for bioaccumulation concern, and benzo [a] pyrene and PCB concentrations were indicated for human health risks. The TIE Study, titled "Sediment Toxicity Identification Evaluation for the Mouths of Chollas and Paleta Creeks, San Diego" (Greenstein et al., 2005), designated chlordane, PAHs, and non-polar organics (including PCBs) as probable causes of toxicity.

9.10.2 Mouth of Paleta Creek

The designated CWA 303(d) listing for San Diego Bay Shoreline at the mouth of Paleta Creek (7th Street Channel) extends from the outlet of Paleta Creek (downstream of the Harbor Drive Bridge and Cummings Road), bound by NAVSTA Pier 8 to the north and Pier 9 (mole pier) to the south, and extends to the end of the piers. The Phase I Study reports that PAHs, PCBs, chlordane, DDT, and lead concentrations indicate potential impairment to aquatic life, and similarly, benzo [a] pyrene and PCB concentrations indicated possible human health risks. The TIE Study report found that PAHs and non-polar organics (including PCBs) were probable causes of toxicity.

9.10.3 NAVSTA San Diego at 32nd Street

The designated CWA 303(d) listing for San Diego Bay Shoreline for NAVSTA San Diego at 32nd Street extends out from the shoreline, with northern and southern limits at Pier 1 (at the mouth of Chollas Creek) and Pier 8 (at the mouth of Paleta Creek), respectively.

Studies associated with TMDL development have not been generated at this point. However, the U.S. Navy has produced a report, titled "Sediment Quality Characterization Naval Station San Diego: Final Summary Report" (Chadwick et al., 1999) which addresses this area. The area between Piers 2 and 7 were classified as high-to-moderately impacted areas. Sediment concentrations exceeding the ERM for a specific contaminant were reported for silver, copper, mercury, zinc, and PCBs. Bioaccumulation data indicate that metals and PAHS were found to bioaccumulate at NAVSTA San Diego sites with mercury, copper, and zinc being "most notable". PCBs were not bioaccumulated.

9.11 Discharge Contributions to the Accumulation of Pollutants at the Shipyard Sediment Site

The U.S. Navy has caused or permitted discharges of pollutants from NAVSTA San Diego to San Diego Bay and has contributed to both the levels of pollutants, and the pollution and nuisance conditions, found at the Shipyard Sediment Site through the pollutant transport mechanisms described in the subsections below.

9.11.1 Chollas Creek Outflow

Chollas Creek consists of freshwater flow with elevated suspended solids containing significant chemical pollutants. Chollas Creek is currently listed on the Clean Water Act (CWA) section 303(d) List of Water Quality Limited Segments (303(d) List) for impairment caused by copper, lead and zinc concentrations exceeding applicable numerical water quality criteria in the California Toxics Rule.[98] San Diego Bay marine sediment at the mouth of Chollas Creek is also listed on the 303(d) List for sediment toxicity and degraded benthic community impairments. As discussed in Section 9.9.2, the U.S. Navy's discharges, including storm water discharges, hull leaching, and cathodic protection, account for approximately 40% of the copper load, 2% of the lead and 18% of the zinc load in Chollas Creek. The U.S. Navy's discharges into Chollas Creek therefore contribute to the pollutants discharged from Chollas Creek outflows into San Diego Bay. The mouth of Chollas Creek is immediately adjacent to the southern boundary of the Shipyard Sediment Site.

Urban runoff in Chollas Creek has been shown to be toxic to both saltwater and freshwater organisms. In-channel wet-weather monitoring from previous storm seasons showed that samples of Chollas Creek stormwater were toxic to the water flea (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*), and the purple sea urchin (*Strongylocentrotus purpuratus*). A study conducted by Southern California Coastal Research Project (SCCWRP) in 2001 to establish the linkage between the Chollas Creek in-channel toxicity measurements and potential impairments in the receiving water of San Diego Bay, (Schiff, 2003), concluded that:

- Stormwater plumes from Chollas Creek extended over an area of two km^2 in San Diego Bay. The study observed that stormwater plumes emanating from Chollas Creek extended between 0.02 and 2.25 km^2 over San Diego Bay during small to moderately-sized storm events. Plumes were easily distinguished using salinity as a conservative tracer of wet weather inputs. Turbidity was also a good tracer of the plume. Stormwater plumes formed relatively thin lenses of 1 to 3 meters, floating on top of the more dense bay water.

[98] See Regional Board Resolution No. R9-2005-0111, A Resolution Adopting An Amendment To The Water Quality Control Plan For The San Diego Region To Incorporate Total Maximum Daily Loads For Dissolved Copper, Lead, And Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005. See also Regional Board Technical Report, Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005.

- Toxicity extended up to 1 km from the Creek mouth and was proportional to the amount of runoff dilution. The SCCWRP study measured toxicity using the purple sea urchin (*Strongylocentrotus purpuratus*) fertilization test in both stormwater samples taken from the creek and samples taken from the stormwater plume in San Diego Bay. This toxicity varied across the gradient of plume influence and was well correlated with the amount of stormwater present in the sample. All samples were salinity adjusted before toxicity testing, so the gradient in toxicity appears to be a function of toxicants present in the stormwater discharges.

- The toxic part of the plume was smaller than the salinity signal. Although toxicity was measured in the stormwater plume emanating from Chollas Creek, the entire plume was not toxic. In the two storms that were mapped from this study, the toxic portion of the plume was approximately 25% to 50% of the plumes' salinity signal. This reduction in the spatial extent of plume toxicity was likely due to dilution and mixing of the plume in the Bay.

- In-channel and plume toxicity was primarily due to trace metals including zinc and copper. TIEs conducted on stormwater samples from both the Creek and from the stormwater plume in the Bay identified dissolved trace metals, predominantly zinc, as the toxicant responsible for the majority of toxicity. Toxicity was eliminated by the addition of the metal chelating agent EDTA. Concentrations of dissolved zinc, and to a lesser extent copper, were high enough in the tested samples to account for the observed toxicity.

Additionally, available U.S. Navy studies (Katz et al., 2003; Chadwick et al., 1999) indicate that the Chollas Creek outflow (plume) to San Diego Bay can introduce pollutants to the Shipyard Sediment Site. The U.S. Navy funded a project in 2001 to quantify storm event mass loading of pollutants from upstream MS4 creek sources and from near-bay U.S. Navy sources as well as to characterize the spatial and temporal impacts from the plumes generated in the bay. Specific conclusions of the study by Katz et al. (2003) include:

- During a single storm event in February 2001, the sediment plume containing pollutants from Chollas Creek was measured to cover an area up to 1.2 km away from the mouth of Chollas Creek. (Although not a specific conclusion of Katz et al., 2003, the Regional Board has inferred that this area would include a portion of BAE Systems' waterside leasehold, which is located approximately 1 km north of the mouth of Chollas Creek, and the entire NASSCO waterside leasehold, located directly adjacent to the Chollas Creek mouth.)

- Storm water plumes from Chollas Creek developed quickly after the start of rainfall and were dispersed through tidal mixing 12 hours after runoff ceased.

- Plume evolution in the bay was well tracked by all real-time measurement parameters though most clearly with salinity, light transmission, and oil fluorescence.

- Contaminants were primarily associated with particles and their strong association with total suspended solids (TSS) provides a good first order approximation for their distribution.
- Upstream storm water sources (i.e. sources upstream of U.S. Navy sources) dominate the loading of contaminants to the bay via Chollas Creek, with discharges from Naval Station property accounting for only an average of 5% of total contaminants.
- Storm water is a continuing source of excessive levels of lead, zinc, chlordane, DDT, and PCBs, and possibly Total PAH and mercury, to the sediment at the mouth of the Chollas Creek.

9.11.2 Tidal Transport of Sediment Resuspended by Ships

Marine sediment pollutant levels and distribution in San Diego Bay are generally consistent with source locations (i.e. marine sediment pollutant levels tend to decrease as a function of distance from source locations). However, there are physical, biological, biochemical, and chemical processes that alter marine sediment and pollutants over time, irrespective of proximity to source locations. In San Diego Bay these processes may include dredging, boat tugging and docking of large vessels, tidal or wind driven currents, bioturbation[99], biological uptake, and dissolution or chemical reactions.

The redistribution of contaminated marine sediment from NAVSTA San Diego to other areas of San Diego Bay can be caused by both ship movements and natural processes in which marine sediment is resuspended into the water column and redistributed by bay currents. Ship movement resuspension of marine sediment occurs as a result of shear forces generated by the thrust of propellers during boat tugging and docking of large naval vessels. Natural resuspension of marine sediment is caused by the shear forces induced by bay currents and wind induced wave action. The majority of sediment resuspension at NAVSTA San Diego is caused by ship movement[100]. Polluted sediment resuspension and transport by tidal currents is a pathway for pollutants from NAVSTA San Diego to migrate to the Shipyard Sediment Site.

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[99] "Bioturbation" refers to the turning and mixing of sediments particles by benthic fauna (animals) or flora (plants). The sediment-water interface increases in area as a result of bioturbation, affecting chemical fluxes and thus exchange between the sediment and water column.

[100] U.S. Navy studies indicate sediment resuspension at NAVSTA San Diego is caused to a much lesser extent by currents and wind waves. San Diego Bay has very mild bottom shear stresses and mild bottom erosion. Under typical conditions the minimum bottom shear needed for the movement of fine bottom sediments is about 1.0 dynes-cm^{-2}. In the pier areas and shipping channel, the average bottom shear stress does not exceed 0.25 dynes-cm^{-2} (Chadwick et al., 1999).

9.11.2.1 Sediment Resuspension by Ships

Ship movements and the associated tub boat activity at NAVSTA San Diego resuspends and redistributes marine sediment and its associated pollutants in San Diego Bay. The U.S. Navy has estimated the loading of sediment in San Diego Bay from NAVSTA San Diego due to resuspension of sediment by ship movements and concluded that this is a significant source of sediment loading to the bay (Chadwick et al., 1999).

The U.S. Navy used their records of ship movement frequency and considered movements away from the piers into the main channel as well as the reverse docking movements. Their analysis also took into account the number of tug boats used. The survey of ship movements at NAVSTA San Diego indicated just less than an average of five ship movements per day with one to two tugs per ship for a total of 1730 ship movements per year[101]. Field measurements of total suspended sediment (TSS) were taken before and after ship movements. The calculations also included subtracting background TSS concentrations.

The U.S. Navy estimated that, from 16,700 to 71,400 kilograms per day (kg/day), an average of 41,700 kg/day, of sediment is resuspended due to ship movements in the NAVSTA San Diego pier area. For comparison purposes, the U.S. Navy reported that (Chadwick et al., 1999):

> *"This daily input represents 29 percent of the background mass of suspended sediment for NAVSTA and adjacent shipping channel. In comparison to TSS loading from Chollas and Paleta Creeks, which drain into NAVSTA, the yearly estimated total sediment resuspension from tug-assisted ship movements was roughly 300 percent of the storm estimated total mass coming from the creeks."*

9.11.2.2 Sediment Transport from Naval Station San Diego

The U.S. Navy utilized a hydrodynamic model (TRIM-2D) and a sediment transport model (TRIM-SED) to evaluate the transport of resuspended sediment and associated chemicals in the vicinity of NAVSTA San Diego (Chadwick et al., 1999). The study showed that the majority of resuspended clay (77.5%) and silt (66.4%) sized sediment is transported from the pier area and deposited outside the pier area. Lesser percentages of the fine sand (31.7%) and coarse sand (10.6%) are also transported and deposited outside of the piers. The modeling concludes that overall, approximately 55% of the sediment resuspended from within the piers are deposited outside the piers.

[101] The ship movements considered were for tug assisted movements (launching/docking) of larger ships with drafts greater than about 22 feet. The movements considered were for launching movements away from the piers into the main channel, the initial acceleration in the main channel until underway, and for docking, i.e., the reverse of this process (Chadwick et al., 1999).

The models were also used to simulate the footprint of suspended sediment and chemical levels that have settled on the bay bottom during and after storm events. The model results show that fine TSS particles (less than 12 microns) extend throughout the bay. Particles sized from 12 to 55 microns are also transported to the front and back sections of the bay but are localized along the eastern shoreline. Medium sized particles settle within 1 to 2 km of the creek outfalls, and the course particles settle right at the outfalls (Chadwick et al., 1999). The model considered only tidal currents as the transport mechanism, not ship movements and associated tugboat activity. Although the simulated footprint of deposition of the suspended sediment was to evaluate inputs from the creeks (e.g. Chollas Creek) during storm events, it is reasonable to assume that the tidal currents and movements would also similarly redistribute and deposit sediment resuspended by ship movements in the pier area. Therefore, it is concluded that tidal movements have resulted in resuspended sediment from NAVSTA San Diego being deposited at the Shipyard Sediment Site.

9.11.3 28th Street Shore Boat Landing Station

As previously described in Section 9.4.2, between the years 1938 and 1956 the U.S. Navy occupied a parcel of land at the south end of the current NASSCO leasehold at the foot of 28th Street, including the 28th Street Pier. This parcel was originally leased from the City of San Diego and was referred to as the 28th Street Shore Boat Landing Station.

The U.S. Navy activities on the north side of the 28th Street Pier included operation of a machine shop, battery shop, planing mill, electric shop, mold loft, mill work office, naval stores, pipe shop, pipe threading area, overhead crane, and boat way. The facilities were used for naval vessel repair including solvent cleaning and degreasing of vessel parts and surfaces, abrasive blasting and scraping for paint removal and surface preparations, metal plating, and surface finishing and painting. Painting and scraping operations-generate wastes that can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters. The types of pollutants found in elevated concentrations at the Shipyard Sediment Site (metals, butyltin species, PCBs, PCTs, PAHs, and TPH) are associated with the characteristics of the waste the U.S. Navy operations generated at the NASSCO site.

10. Finding 10: Clean Water Act Section 303(d) List

Approximately 55 acres of ~~The~~ San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act Section 303(d) list of water quality limited segments for elevated levels of copper, mercury, zinc, ~~polynuclear aromatic hydrocarbons (~~PAHs~~)~~, and ~~polychlorinated biphenyls (~~PCBs~~)~~ in the marine sediment. These pollutants are impairing the aquatic life, aquatic-dependent wildlife, and human health beneficial uses designated for San Diego Bay. The Shipyard Sediment Site~~s~~ ~~occupy~~ occupies this shoreline. The Regional Board has determined that issuance of a cleanup and abatement order (in lieu of a Total Maximum Daily Load program) is the appropriate regulatory tool to use for correcting the impairment at the Shipyard Sediment Site.

10.1 Clean Water Act Section 303(d) List

Clean Water Act Section 303(d) requires states to identify impaired waters that do not meet, or are not expected to meet by the next listing cycle, applicable water quality standards[102] after the application of certain technology-based controls and schedule such waters for development of Total Maximum Daily Loads[103]. The states accomplish this by listing such waters and submitting an updated list from time to time (currently on a biennial basis in even numbered years) to U.S. EPA.

An impaired waterbody is one that does not attain and maintain water quality standards, due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. A threatened waterbody is one that currently attains water quality standards but existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time the next list is required to be submitted to U.S. EPA.

The Shipyard Sediment Site, was added to the 2002 CWA Section 303(d) List under the name "San Diego Bay Shoreline between Sampson and 28th Streets" as an impaired waterbody segment due to elevated concentrations of copper, mercury, polynuclear aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) in bay bottom sediment. Fact sheets prepared by the Regional Board and submitted to the State Water Resources Control Board (SWRCB) in support of the listing are provided in the Appendix for Section 10. The SWRCB adopted the 2002 CWA Section 303(d) list of water quality limited segments at a February 4, 2003 Board Meeting and the list was approved by the U.S. EPA in July 2003.

[102] Water quality standards for a water body consist of its beneficial uses, criteria to protect those uses (referred to as water quality objectives in California), and an antidegradation policy. (40 CFR part 131).

[103] A TMDL is the sum of waste load allocations for point sources, load allocations for nonpoint sources, and natural background sources of an impairing pollutant. (40 CFR §130.2(i)).

Regional Boards have wide latitude, numerous options, and some legal constraints that apply when determining how to address impaired waters. All violations of water quality standards should be addressed, and the Regional Board may use any combination of existing regulatory tools to do so. Existing regulatory tools include individual or general waste discharge requirements (be they under Chapter 4 or under Chapter 5.5 (NPDES permits) of the Porter-Cologne Water Quality Control Act), individual or general waivers of waste discharge requirements, enforcement actions (e.g. cleanup and abatement order), interagency agreements, regulations, basin plan amendments, and other policies for water quality control.

The Regional Board has determined that issuance of a cleanup and abatement order (in lieu of a Total Maximum Daily Load program) is the appropriate regulatory tool to use for correcting the impairment at the Shipyard Sediment Site based on the following considerations:

1. Pollutant discharges from NASSCO and BAE Systems (formerly Southwest Marine), two primary sources of the marine sediment contamination at the Shipyard Sediment Site, have been significantly curtailed in recent years as the result of improvements in best management practices implementation.
2. Pollutant contributions to the Shipyard Sediment Site from Chollas Creek outflows will be gradually and significantly reduced over the next ten years as the result of implementation of the Chollas Creek Metals TMDL[104] and future planned TMDLs for Chollas Creek.
3. Discharges from other sources to the Shipyard Sediment Site not described in Items 1 and 2 above are either entirely historical contributions and no longer occurring or can be controlled or terminated using existing Regional Board regulatory tools such as waste discharge requirements or enforcement action.
4. The source control efforts summarized above will likely be sufficient to eliminate or significantly reduce continuing accumulation of pollutants at the Shipyard Sediment Site and ensure that remedial measures required under the cleanup and abatement order will not have to be repeated at a later date.
5. Attainment of the Cleanup Levels prescribed in Directive A of Cleanup and Abatement Order No. R9-2005-0126 will result in restoration of beneficial uses at the Shipyard Sediment Site and provide a basis for removing the Shipyard Sediment Site from the current Clean Water Act Section 303(d) list.

[104] See Regional Board Resolution No. R9-2005-0111, A Resolution Adopting an Amendment to the Water Quality Control Plan for the San Diego Region to Incorporate Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005. See also Regional Board Technical Report, Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay, June 29, 2005.

11. Finding 11: Sediment Quality Investigation

NASSCO and BAE Systems (formerly Southwest Marine) conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation*, *September 2003* (Shipyard Report). Unless otherwise explicitly stated, the Regional Board's finding and conclusions in this Cleanup and Abatement Order are based on the data and other technical information contained in the Shipyard Report ~~report~~ prepared by NASSCO's and BAE Systems' ~~Southwest Marine's~~ consultant, Exponent. ~~entitled *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003*.~~

11.1 NASSCO and Southwest Marine Detailed Sediment Investigation

On February 21, 2001, the Regional Board adopted Resolution Nos. 2001-02 and -03 directing the Executive Officer to issue Water Code section 13267 letters to NASSCO and Southwest Marine requiring the submission of a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives.

On June 1, 2001, the Regional Board Executive Officer directed, under the authority provided in Water Code section 13267, NASSCO and Southwest Marine (currently BAE Systems) to conduct a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives. The study was conducted in accordance with the Regional Board document, *Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards, June 1, 2001.*

As a first step, NASSCO and BAE Systems developed and submitted to the Regional Board a Work Plan (Exponent, 2001a) and time schedule for performance of a site assessment and development of sediment cleanup levels, sediment cleanup alternatives, and cleanup costs. Following Regional Board concurrence with the work plan NASSCO and BAE Systems conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003* (Shipyard Report) (Exponent, 2003).

11.2 Data Quality

The Work Plan for the Detailed Sediment Investigation included a field sampling plan (FSP) (Appendix A, Exponent, 2001a). The FSP presented the sampling methods that would be used during the investigation, including field sampling locations and procedures, the use of quality control samples, field data reporting and field custody procedures, and sample packaging and shipping requirements.

The Work Plan also included a quality assurance project plan (QAPP) (Appendix B, Exponent, 2001a) to ensure that the quality of the data was sufficiently high to support its intended use of determining the nature and extent of contamination, determining biological effects, assessing ecological and human health risks, and establishing remediation measures for the Shipyard Sediment Site. The QAPP described the procedures for field collection of samples, sample handling and custody (including preservation and holding time requirements), analytical methods, field and laboratory quality control, instrument maintenance and calibration, data validation methods, and data management. Data validation methods were provided for field procedures, chemical analyses, toxicity tests and laboratory bioaccumulation, and benthic macroinvertebrate identification.

The Shipyard Report presented a Quality Assurance Report for Chemistry Data that provided a data quality review (data validation and data quality assessment) of the data collected during the Detailed Sediment Investigation. The review verified that quality assurance and quality control (QA/QC) procedures were completed and documented as required by the QAPP. The data quality of chemistry data was determined by Exponent to be sufficiently high and no data were rejected. (Appendix F, Exponent, 2003)

Quality Assurance Reports were also provided for Toxicity Tests (Amphipod Toxicity, Echinoderm Toxicity, Sediment-Water Interface Toxicity, and Dilution Series Toxicity), Bioaccumulation Tests, and Benthic Macroinvertebrate Identification. The quality assurance reviews identified whether results met applicable performance standards, whether any deviations or inconsistencies with the specifications of the statement of work (with each contracted laboratory) occurred and then assessed whether there were any resulting affects on the quality of the data. Exponent determined that the data generated from the Detailed Sediment Investigation were acceptable for their intended use. (Appendices H, J, and L, Exponent, 2003)

11.3 Stakeholder Involvement

The Regional Board conducted a series of stakeholder meetings and public workshops during the course of NASSCOs and BAE Systems sediment investigation and received valuable input, which was factored into the investigation. At the meetings and workshops, experts, and interested parties representing the shipyards and a diverse group of stakeholders had the opportunity to provide critical input and share knowledge on various aspects of the Shipyard Sediment Site investigation, including review of the work plan. The stakeholder group included representatives from the Audubon Society;

California Department of Fish and Game; City of San Diego, Environmental Health Coalition; National Oceanic and Atmospheric Administration (NOAA); San Diego Baykeeper; San Diego Unified Port District; Sierra Club; Southern California Coastal Water Research Project (SCCWRP); Surfrider Foundation; University of California, Davis, Marine Pollution Studies Laboratory; U.S. Fish and Wildlife; and U.S. Navy.

A summary of the meetings, workshops, and significant documents for the Shipyard Sediment Site investigation are listed in the Table 11-1 below.

Table 11-1. List of Meetings, Workshops, and Significant Documents

	Item or Event	Date
1	Adopt Resolution Nos 2001-002 and 2001-003	2/21/2001
2	Issue Water Code section 13267 letters to NASSCO and BAE Systems Southwest Marine (now BAE Systems)	6/01/2001
3	Issue Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards.	6/01/2001
4	Public Workshop #1	8/03/2001
5	Stakeholder Meeting #1	10/12/2001
6	Stakeholder Meeting #2	1/29 - 30/2002
7	Stakeholder Meeting #3	3/28 - 29/2002
8	Public Workshop #2	6/18/2002
9	Stakeholder Meeting #4	8/22/2002
10	Technical Meeting #1	12/12/2002
11	Technical Meeting #2	1/22 - 23/2003
12	Regional Board Meeting – Status Report #1	9/10/2003
13	NASSCO and BAE System (formerly Southwest Marine) Detailed Sediment Investigation released for review.	10/10/2003
14	Regional Board Meeting – Status Report #2	11/12/2003
15	Public Workshop #3	11/14/2003
16	Release Tentative CAO R9-2005-0126	5/1/2005
17	Public Workshop #4	6/29/2005
18	Regional Board Meeting – Status Report #3	8/10/2005
19	Pre-Hearing Conference #1	8/26/2005
20	Pre-Hearing Conference #2	12/06/2005
21	Advisory Team / Cleanup Team public meeting	12/12/2005

It is anticipated that the Regional Board will conduct additional prehearing conferences and workshops and at least one Regional Board public hearing in considering the issuance of a final Cleanup and Abatement Order.

11.4 Conclusion

The Regional Board's findings in the Tentative Cleanup and Abatement Order and conclusions in this Technical Report are based primarily on the data and other technical information provided in the Shipyard Report. The Regional Board has reviewed the Quality Assurance Reports and found that the data reported in the Shipyard Report are found to be of sufficient quality to be used to develop the Regional Board's findings and conclusions.

The Regional Board's Technical Report identifies those instances where other data and technical information, in addition to that provided in the Shipyard Report, are used to support the Findings in the tentative Cleanup and Abatement Order and for the Regional Board's management decisions.

12. Finding 12: Aquatic Life Impairment

Aquatic life beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic life beneficial uses include: Estuarine Habitat (EST), Marine Habitat (MAR), and Migration of Aquatic Organisms (MIGR). This finding is based on the considerations described below in this *Impairment of Aquatic Life Beneficial Uses* section of the Cleanup and Abatement Order.

12.1 Aquatic Life Beneficial Uses

There are three beneficial uses designated in the Basin Plan for San Diego Bay (RWQCB, 1994), which must be fully protected in order to provide for the protection of aquatic life. The three aquatic life beneficial uses are as follows:

- Estuarine Habitat (EST) – Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
- Marine Habitat (MAR) - Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
- Migration of Aquatic Organisms (MIGR) – Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

The concentrations of the pollutants present in the marine sediment within and adjacent to the Shipyard Sediment Site causes or threatens to cause a condition of pollution or contamination that adversely impacts these three beneficial uses and thereby constitutes a threat to aquatic life. Information supporting this conclusion is contained in Sections 13 through 21 of this Technical Report.

13. Finding 13: Multiple Lines of Evidence Weight-of-Evidence Approach

~~There is no single method that measures the adverse effects of contaminated sediments at all times and to all organisms~~. The Regional Board used a weight-of-evidence approach based upon multiple lines of evidence ~~approach to assess~~ to evaluate the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring and evaluating exposure and adverse effects to the benthic macroinvertebrate community and to fish using data from multiple lines of evidence and best professional judgment. Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The Regional Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of ~~polynuclear aromatic hydrocarbon (~~PAH~~)~~ breakdown products in fish bile.

13.1 No Single Method Can Measure the Effects of Contaminated Sediment

Pollutants in sediment can cause adverse effects either through direct toxicity to benthic organisms or through bioaccumulation and food chain transfer to human and wildlife consumers of fish and shellfish. As noted by U.S. EPA (1992a), there is no single method that will measure all contaminated sediment effects at all times and to all biological organisms. For example, sediment chemistry provides unambiguous measurements of pollutant levels in marine sediment, but provides inadequate information to predict biological impact. Benthic communities can provide a direct measurement of community impacts, but are subject to disturbances that are not necessarily caused by pollutant driven sediment toxicity (e.g. low dissolved oxygen). Measurements of sediment toxicity directly measure biological impacts and integrate the effect(s) of various pollutant mixtures, but are subject to test imprecision and lack of consistent correlations with biological community effects. In addition, the toxicity test organisms may not adequately reflect the sensitivity of the full range of species comprising the benthic community. Reliance on any one of these measurement endpoints (chemistry, benthic communities and toxicity) to evaluate exposure and effects is problematic for characterizing risk from sediment pollutants. In contrast, a weight of evidence assessment using all three measurement endpoints gives the assessor much more information to reach conclusions.

13.2 Weight-Of-Evidence Approach

Based on these considerations, the assessment of potential adverse effects from contaminated sediment is best performed using a “weight-of-evidence approach”. The central tenet of a weight-of-evidence approach is that “multiple lines of evidence” should support decision-making. The corollary is that no single line of evidence should drive decision-making (unless a single line of evidence gives all the information necessary, and decision makers are willing to accept the outcome). The weight-of-evidence approach is commonly defined in the literature as a determination related to possible ecological impacts based upon multiple lines of evidence, which contribute to an overall evaluation and conclusion. This determination incorporates judgments referred to as “best professional judgment” (BPJ) concerning the quality, extent, and congruence of the data contained in the different lines of evidence. BPJ comprises the use of expert opinion and judgment based on available data and site-situation specific conditions to determine, for example, environmental status or risk. BPJ can be initiated in cases where there are extensive data but few uncertainties and in cases where there are few data and many uncertainties.

13.3 Regional Board Approach

The Regional Board applied the weight-of-evidence approach principles to evaluate potential risks to aquatic life beneficial uses from the existing levels of pollutants at the Shipyard Sediment Site. The approach focused on evaluating the exposure and adverse impacts to the benthic macroinvertebrate community and to fish using multiple lines of evidence including sediment and pore water chemistry, laboratory studies of toxicity and bioaccumulation, benthic community evaluation, fish histopathology analyses and analyses of PAH breakdown products in fish bile. The data used to establish these lines of evidence are contained in the NASSCO and BAE Systems’ report referenced in Section 11 of this Technical Report (Exponent, 2003). The Regional Board’s evaluation of these data and multiple lines of evidence are discussed in Sections 14 through 20 of this Technical Report.

14. Finding 14: Sediment Quality Triad Measures

The Regional Board used lines of evidence organized into a ~~the~~ sediment quality triad ~~approach~~ to evaluate potential risks to the benthic community from pollutants present in the Shipyard Sediment Site. The sediment quality triad provides a "weight-of-evidence" approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. All three measures provide a framework of complementary evidence for assessing the degree of ~~pollution~~ pollutant-induced degradation in the benthic community.

14.1 Sediment Quality Triad Measures

The sediment quality triad is one of the tools used by the Regional Board to evaluate the potential risks to the benthic community from pollutants present at the Shipyard Sediment Site. These assessments are best performed using a "weight-of-evidence" approach that incorporates sediment chemistry, laboratory studies of toxicity or bioaccumulation, and evaluation of the benthic community. These lines of evidence can be organized into a sediment quality triad that provides the framework for a weight-of-evidence approach to sediment quality assessment by integrating results from sampling of the sediment chemistry, sediment toxicity, and benthic community composition within a defined area. All three measures provide complementary evidence for assessing the degree of contamination-induced degradation in the benthic community. Agreement or disagreement among these three measures at each sampling site or among sites may provide different interpretations of the ecological dynamics within an area. The sediment quality triad framework is used throughout the United States in sediment quality assessments of contaminated bay sediment and prospective dredge material. The sediment quality triad framework is recommended by the United States Environmental Protection Agency (U.S. EPA 2000b and 2000c) and is considered to be a standard method for qualitatively assessing the relationship between chemical concentrations and biological effects. The State Water Resources Control Board is currently developing criteria for sediment quality based on the use of multiple lines of evidence including the sediment quality triad of measurements.

The sediment quality triad framework uses three independent lines of data in sediment quality assessment. The strength of using sediment chemistry, toxicity, and benthic community composition information in this approach is that it uses both chemical and biological measures from the same sediment sample to characterize sediment quality (Long, 1989). Sediment chemistry provides direct measurements of the pollutants found in the surficial sediment layer only. Sediment toxicity is the second component of the triad and toxicity is determined in the laboratory with bioassay tests. If toxicity is observed in the bioassay tests, it can be assumed that there are pollutants in the sediment bioavailable at levels high enough to cause a significant response. Lastly, benthic data on community composition and structure provides evidence of the current condition of the benthic community response to its environment under in situ conditions. This benthic data provides confirmatory evidence concerning the potential impacts that contaminated sediment is having on the resident benthic community.

The data provided by each line of evidence for each sample is compared against pre-determined threshold values in order to rank the level of station impairment. Each line of evidence provided is then integrated into an overall weight-of-evidence evaluation that focuses on identifying the likelihood that the health of the benthic community is adversely impacted at a given station due to the presence of known chemicals of concern related to the site. Although the sediment chemistry, toxicity, and benthic community data should be complementary, the degree of impairment implied by each line of evidence may not be in complete agreement because they measure different properties of the surficial sediment (Long, 1989).

A detailed description of the Shipyard Sediment Investigation decision matrices, individual station scores, and weight-of-evidence results are presented and summarized in Section 16 of this Technical Report.

15. Finding 15: ~~Baseline~~ Reference Sediment Quality Conditions

~~Implicit in evaluating if aquatic life impairments exist using the Sediment Quality Triad approach is the assumption that pollution in terms of sediment chemistry, toxicity, and benthic community structure is worse at the Shipyard Sediment Site than other areas in San Diego Bay. The Regional Board selected a pool of reference stations in San Diego Bay to characterize the baseline condition (Baseline Pool).~~ The ~~pool~~ Regional Board selected a group of reference stations ~~were sampled~~ from three independent sediment quality investigations to contrast pollution conditions at the Shipyard Sediment Site with conditions found in other relatively cleaner areas of San Diego Bay not affected by the Shipyard Sediment Site: (1) Southern California Bight 1998 Regional Monitoring Program (Bight 98), (2) 2001 Mouth of Chollas Creek and Mouth of Paleta Creek TMDL studies, and (3) 2001 NASSCO and Southwest Marine (now BAE Systems) Detailed Sediment Investigation. Stations from these studies were selected to represent selected physical, chemical, and biological characteristics of San Diego Bay. Criteria for selecting acceptable reference stations included low levels of anthropogenic pollutant concentrations, locations remote from pollution sources, similar biological habitat to the Shipyard Sediment Site, sediment total organic carbon (TOC) and grain size profiles similar to the Shipyard Sediment Site, adequate sample size for statistical analysis, and sediment quality data comparability. The reference stations selected for the ~~Baseline Pool~~ Reference Sediment Quality Conditions are identified ~~shown~~ below.

Reference Stations Used To Establish ~~Baseline~~ Reference Sediment Quality Conditions

2001 Chollas/Paleta Reference Station Identification Number	2001 NASSCO/~~Southwest Marine~~ BAE Systems Reference Station Identification Number	1998 Bight'98 Reference Station Identification Number
2231	2231	2235
2243	2243	2241
2433	2433	2242
2441	2441	2243
2238		2256
		2257
		2258
		2260
		2265

15.1 Guiding Principles for Determination of Reference Sediment Quality Conditions

The evaluation of benthic community impairment using the Sediment Quality Triad weight-of-evidence approach requires information on both a contaminated marine sediment site and the general condition of the surrounding water body in terms of sediment chemistry, toxicity, and benthic community structure. This information is used to discriminate between pollution effects[105] at the contaminated marine sediment site with that found in other relatively cleaner areas (referred to as reference sites) of the surrounding water body. When establishing a finding of benthic community impairment using the Sediment Quality Triad approach, implicitly the assumption is made that pollution effects, in terms of chemistry, toxicity, and benthic community indices data, are more degraded in the localized contaminated marine sediment area of concern than the surrounding water body. The comparison of pollution conditions is used to identify areas at the contaminated marine sediment area of concern that may require remediation or cleanup to protect or restore aquatic life beneficial uses.

The choice of appropriate reference sites is critical. Reference stations for marine sediment quality investigations are best developed from a population of sites. Multiple reference sites are preferred and the number of background reference stations and the number of sample replicates per reference station depends on the statistical design of the sediment quality investigation. Generally, appropriate background reference stations are positioned in relatively clean areas remote from known pollution sources. The sediment in both reference and contaminated marine sediment sites should have the same gross physical and chemical characteristics, including such parameters as grain size, particulate organic carbon, and biological parameters (i.e., resident biota, particularly the benthos) should also be broadly similar in terms of the distribution of major taxa (e.g., family level) and biomass.

The term reference conditions (i.e. the sediment quality conditions described by the reference stations) are often used interchangeably with the terms “background reference conditions”, “background conditions”, and “ambient conditions”. Background conditions can be defined in terms of a “pre-industrial background” – the pristine, pre-industrial sediment quality conditions often reflected in deep native marine sediment. Alternatively, background can be defined in terms of an "ambient background” or “contemporary background” – average sediment quality conditions in areas removed from sources of contaminants, recognizing that there may no longer be pristine surface marine sediment in a given geographic area of a waterbody.

[105] An effect is defined as being significantly different from the condition at the reference site.

The reference stations used to define background conditions also have an important role to play in determining the maximum extent of cleanup at a particular site. Water Code section 13304 authorizes the Regional Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge.) Under the terms of Resolution No. 92-49, *Policies And Procedures for Investigation and Cleanup And Abatement of Discharges Under Water Code Section 13304*, the Regional Board is obligated to have a presumptive cleanup goal to require cleanup to attain background water quality conditions (SWRCB, 1996). The Regional Board will establish a cleanup level above background water quality conditions, only if the Board determines that it is technologically or economically infeasible to achieve background water quality conditions. Resolution No. 92-49 further provides that actions for cleanup and abatement should not be interpreted to require "… cleanup and abatement which achieves water quality conditions that are better than background conditions."

Accordingly current practice in selecting a reference site inevitably requires some degree of compromise to meet the somewhat ambiguous requirements of a reference site "substantially free" of contaminants, yet having physical and chemical characteristics and biological parameters "broadly similar" to the contaminated marine sediment, and reflective of conditions "that existed before the discharge".

15.2 Shipyard Sediment Site Reference Sediment Quality Conditions

On June 9, 2003, the Regional Board issued a letter titled "*Regional Board Final Position on a Reference Pool for the NASSCO, Southwest Marine, Mouth of Chollas Creek, and 7th Street Channel Sediment Investigations.*" The letter specified the reference stations to be used in the Shipyard Sediment Site investigation for comparisons to determine statistically significant differences between site sediment quality conditions and reference sediment quality conditions (RWQCB, 2003b). Furthermore, this letter also outlined the statistical procedures and prediction limits to be generated with this data.

This pool of reference data, referred to as the "Final Reference Pool", were compiled from three independent sediment quality investigations: (1) Southern California Bight 1998 Regional Monitoring Program (Bight 98) (SCCWRP, 2003), (2) 2001 Mouth of Chollas Creek and Mouth of Paleta Creek TMDL studies (Cholla/Paleta study) (SCCWRP and U.S. Navy, 2005b), and (3) 2001 NASSCO and Southwest Marine (now BAE Systems) Detailed Sediment Investigation (Exponent, 2003). The Final Reference Pool consisted of 2 stations from the Chollas/Paleta study, 3 stations from the Shipyard Sediment Site investigation, and 17 stations from the Bight 98 study for a total of 22 reference stations.

At the direction of the Regional Board, Exponent (consultant for the shipyards) used the "Final Reference Pool" as their basis for evaluating the sediment chemistry, toxicity, and benthic community conditions at the Shipyard Investigation Site. The results of their evaluation can be found in their report titled *"NASSCO and Southwest Marine Detailed Sediment Investigation, Volume I, October 10, 2003"*.

Subsequent to establishing the "Final Reference Pool", the Regional Board decided to conduct a separate analysis of toxicity, benthic community, and sediment chemistry data from the Shipyard Sediment Site investigation with another reference pool of data. While the "Final Reference Pool" established a pristine background sediment quality condition for San Diego Bay, it was not reflective of the contemporary ambient background condition of San Diego Bay in the absence of the of the Shipyard Sediment Site discharges.

Consistent with the principles described in Section 15.1, the Regional Board selected stations to establish a reference condition reflective of the sediment quality condition that existed within and adjacent to the Shipyard Sediment Site before the discharges occurred. This contemporary ambient background condition is not representative of pristine pre-industrial background condition as it considers the global spread of pollutants in the bay from current and historical discharges. Factoring in low levels of pollutants at a reference site is consistent with U.S. EPA guidelines on selecting and establishing reference conditions. In the U.S. EPA's Sediment Classification Methods Compendium (U.S. EPA, 1992a), it states the following concerning reference sediment:

> *"A reference sediment, on the other hand, is collected from a location that may contain low to moderate levels of pollutants resulting from both the global inputs and some localized anthropogenic sources, representing the background levels of pollutants in an area..."*

The U.S. EPA also states in its Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guidance document (U.S. EPA, 2000c) the following concerning reference sediment:

> *"Reference Site Criteria – The overall goal in establishing the reference condition from carefully selected reference sites is to describe the optimal biota that investigators may expect to find at the test sites of interest in the absence of stresses."*

Thresholds for sediment toxicity and benthic community health were not used in the selection of reference stations for inclusion in the reference station pool. The typical variability in toxicity and benthic communities in San Diego Bay was considered to be an important characteristic of the pool. Candidate reference stations were not eliminated based on a single toxicity or benthic community endpoint. If the weight-of-evidence for a particular candidate reference station suggested non-contaminant related interferences, the station remained in the reference pool. The resulting reference condition was used to represent the contemporary ambient background condition that would be expected to exist at the Shipyard Sediment Site in the absence of direct influence from point source discharges.

The Regional Board's new pool of reference stations selected for the Shipyard Sediment Site was originally developed for site assessment work at the Mouths of Chollas Creek and Paleta Creek TMDL projects. In the report titled "Sediment Assessment Study for the Mouths of Chollas and Paleta Creek, San Diego, Phase 1 Final Report" (SCCWRP and U.S. Navy, 2005b), a pool of stations was used to establish a "baseline condition". This reference pool of data was used in the comparisons to the investigation sediment chemistry, toxicity, and benthic community data. For simplicity purposes the term "Baseline Condition" now refers to the Reference Condition or Reference Pool of data used for comparisons in the Shipyard Investigation. Table 15-1 summarizes the sediment investigation projects and the specific reference station locations, using the SCCWRP station identification numbering, that make up the reference pool of data.

A summary of the grain size and TOC is presented in Table 15-2 and a summary of the Regional Board evaluation for each selected reference station is presented in Table 15-3 below.

Table 15-1. Reference Stations Selected from Three Independent Sediment Studies

2001 Chollas/Paleta Reference Stations	2001 NASSCO/BAE Systems Reference Stations	1998 Bight'98 Reference Stations
2231	2231	2235
2243	2243	2241
2433	2433	2242
2441	2441	2243
2238		2256
		2257
		2258
		2260
		2265

Table 15-2. Comparison of the Range of Physical Characteristics Between the Shipyard Sediment Site and the Reference Condition Reference Stations

Area	Fines (%)	Total Organic Carbon (%)
NASSCO [1]	42.7 to 89.1	1.4 to 2.3
BAE Systems [2]	31.8 to 94.2	1.6 to 4.1
Baseline Condition	13 to 82.8	0.4 to 1.8

[1] Twelve of 15 NASSCO stations with triad data are within the % fines range for the Reference Pool. Five of 15 NASSCO stations with triad data are within the % TOC range for the Reference Pool.

[2] Twelve of 15 BAE Systems stations with triad data are within the % fines range for the Reference Pool. Two of 15 BAE Systems stations with triad data are within the % TOC range for the Reference Pool.

Table 15-3. Evaluation of the Selected Reference Stations

Study	Station ID	Regional Board Evaluation
Chollas/Paleta (CP) Study	2231	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity[1]: 76% Benthic Community: BRI Score = 39.5 (Response Level 1 – Greater than 5% of reference species lost). Atypical benthos due to high abundance of one species not previously recorded at this station. Location: Mid Bay Comments: Sediment chemistry and control adjusted toxicity data retained but benthic community data not used in the reference pool.
	2243	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity[1]: 84% Benthic Community: BRI Score = 55.1 (Response Level 3 – Greater than 50% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results. Weight of evidence suggests that the high BRI score may be may be caused by factors other than pollution.
	2433	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 84% Benthic Community: BRI Score = 22.8 (Reference Level). Location: Northern Bay Comments: Retain all station data based on triad results

Study	Station ID	Regional Board Evaluation
CP Study	2441	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 82% Benthic Community: BRI Score = 30 (Reference Level). Location: Northern Bay Comments: Retain all station data based on triad results.
	2238	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 90% Benthic Community: BRI Score = 60.3 (Response Level 3 – Greater than 50% of reference species lost). Location: Southern Bay Comments: Retain all station data based on triad results. Weight of evidence suggests that the high BRI score may be may be caused by factors other than pollution.
NASSCO/BAE Systems Shipyards (SY Investigation)	2231	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 84% Benthic Community: BRI Score = 31 (Reference Level). Atypical benthos due to high abundance of one species not previously recorded at this station. Location: Mid Bay Comments: Sediment chemistry and control adjusted toxicity data retained but benthic community data not used in the reference pool.

Study	Station ID	Regional Board Evaluation
SY Investigation	2243	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 92% Benthic Community: BRI Score = 45.1 (Response Level 2 – Greater than 25% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.
	2433	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 96% Benthic Community: BRI Score = 16.8 (Reference Level) Location: Northern Bay Comments: Retain all station data based on triad results.
	2441	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 95% Benthic Community: BRI Score = 19.9 (Reference Level). Location: Northern Bay Comments: Retain all station data based on triad results.

Study	Station ID	Regional Board Evaluation
Bight 98	2235	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 71% Benthic Community: BRI Score = 42.1 (Response Level 2 – Greater than 25% of reference species lost). Location: Southern Bay Comments: Retain all station data based on triad results. Weight of evidence suggests that the high BRI score may be may be caused by factors other than pollution.
	2241	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 98% Benthic Community: BRI Score = 34.7 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.
	2242	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 92% Benthic Community: BRI Score = 36.6 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.

Study	Station ID	Regional Board Evaluation
Bight 98	2243	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 96% Benthic Community: BRI Score = 36.4 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.
	2256	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 100% Benthic Community: BRI Score = 37.9 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.
	2257	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 91% Benthic Community: BRI Score = 38.1 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.

Study	Station ID	Regional Board Evaluation
Bight 98	2258	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 92% Benthic Community: BRI Score = 43.3 (Response Level 2 – Greater than 25% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results. Weight of evidence suggests that the high BRI score may be may be caused by factors other than pollution.
	2260	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 73% Benthic Community: BRI Score = 39.1 (Response Level 1 – Greater than 5% of reference species lost). Location: Mid Bay Comments: Retain all station data based on triad results.
	2265	Sediment Chemistry: No chemical exceeded its ERM or consensus based guideline value. Amphipod Toxicity: 85% Benthic Community: BRI Score = 26.7 (Reference Level) Location: Mid Bay Comments: Retain all station data based on triad results.
Notes: Amphipod percent survival is control adjusted. [1]Potential outliers removed from data set and control adjusted.		

In the Regional Board's evaluation of the reference pool stations, three stations in the pool have amphipod less than 80 percent control adjusted survival. Furthermore, five reference stations have BRI scores that are in the Response Level 2 and 3 range. This marginal amphipod and benthic community data could be considered less than ideal for a reference pool, however, the weight of evidence from the other biological and chemical endpoints for the same reference stations do not clearly indicate sediment contamination. From the eight stations with the marginal amphipod or marginal benthic community data, only one station has both marginal amphipod survival and a BRI score in the Response Level 2 category therefore a strong case is not provided for exclusion of the station data based solely on one marginal data point. Accepting all the reference station data, except for the noted benthic community data from station 2231, also fits into the Regional Board's intent of establishing a reference sediment quality condition that represents contemporary ambient background condition of San Diego Bay in the area of the Shipyard Sediment Site that could be expected to exist in the absence of the Shipyard Sediment Site discharges. This includes accepting some level of natural variability that can exist due to factors other than sediment contamination.

The Regional Board's selection of reference stations was based upon a review of the data from three independent studies. These studies included the following:

1. Sediment assessment study for the mouths of Chollas and Paleta Creek, San Diego Bay, 2001 (SCCWRP and U.S. Navy, 2005b);
2. NASSCO and Southwest Marine (now BAE Systems) Detailed Sediment Investigation, 2001 (Exponent, 2003); and
3. Southern California Bight 1998 Regional Monitoring Program (Bight 98) (SCCWRP, 2003).

The following factors were considered in selecting the reference stations:

1. Low contaminant concentrations representative of baseline conditions;
2. Comparable habitat to the study sites;
3. Adequate sample size for statistical analysis; and
4. Data comparability between the different studies.

The resulting reference pool of data consists of 18 reference stations. Nine of the reference stations were taken from the Bight 98 study (SCCWRP, 2003). The remaining nine reference stations originated from the Chollas/ Paleta Creek study, and the NASSCO/BAE Systems study. The range of data sets provides greater temporal and methodological comparability to the site data. While this data pool is specifically developed to define the Chollas and Paleta Creek reference conditions, the pool is also considered to be applicable to the NASSCO and BAE Systems investigation because of the following:

- The pool includes some reference stations used by NASSCO's and BAE's consultant, Exponent in a report entitled "NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003" (Exponent, 2003);
- The Chollas and Paleta reference stations included in the pool are the same reference stations sampled by NASSCO's and BAE's consultant, Exponent, in the Shipyard investigation (with the exception of one station);
- The reference stations from the Chollas, Paleta, and Shipyard studies were sampled within the same time frame (July and August 2001);
- The pool of reference stations from the Chollas, Paleta, and Bight'98 studies followed the same sampling and analysis protocols as the Shipyard reference stations; and
- The range of fines content for the reference pool is consistent with the levels of fines observed at the Shipyard Site stations.

Individual and summary sediment chemistry, toxicity, and benthic information on the 18 reference stations used in the reference pool can be found in the Appendix for Section 15 of this Technical Report. A description of the initial reference station screening process for the Chollas and Paleta and Shipyard Sediment Site investigation and a description the Bight 98 reference stations selection process is part of this appendix.

16. Finding 16: Sediment Quality Triad Results

~~Based on the synoptic measures of sediment chemistry, toxicity, and benthic community composition at the Shipyard Sediment Site,~~ The Regional Board categorized 14 of 30 Sediment Quality Triad sampling stations at the Shipyard Sediment Site as having sediment pollutant levels "likely" to adversely affect the health of the benthic community. These results are based on the synoptic measures of sediment chemistry, toxicity, and benthic community structure at the Shipyard Sediment Site. ~~The results of this analysis are summarized in the table below.~~

~~**Results of the Sediment Quality Triad Approach**~~

~~Site~~	~~Station~~	~~Sediment Chemistry(1)~~	~~Toxicity(2)~~	~~Benthic Community(3)~~	~~Weight-of-Evidence Category(4)~~
~~NASSCO~~	~~NA01~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA03~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA04~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA05~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA06~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA07~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA09~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~NA11~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~NA12~~	~~Moderate~~	~~Moderate~~	~~Low~~	~~Possible~~
	~~NA15~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA16~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~NA17~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~NA19~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~NA20~~	~~Moderate~~	~~Low~~	~~Moderate~~	~~Likely~~
	~~NA22~~	~~High~~	~~Moderate~~	~~Moderate~~	~~Likely~~
~~SWM~~	~~SW02~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW03~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW04~~	~~High~~	~~Low~~	~~Moderate~~	~~Likely~~
	~~SW08~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW09~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW11~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW13~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW15~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW17~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW18~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW21~~	~~High~~	~~Low~~	~~Low~~	~~Possible~~
	~~SW22~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW23~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW25~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~
	~~SW27~~	~~High~~	~~Moderate~~	~~Low~~	~~Likely~~

~~(1) Relative likelihood that the chemicals present in the sediment are adversely impacting organisms living in or on the sediment based on the comparison to sediment quality guidelines (e.g. Effects Range Medium (ERM), Sediment Quality Guideline Quotients (SQGQ) and to the reference condition.~~

(2) ~~Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.~~
(3) ~~Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.~~
(4) ~~Relative likelihood that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.~~

16.1 Sediment Quality Triad Results

The triad analysis presented in the Shipyard Report does not use the sediment chemistry results because they concluded that there was not a statistically significant relationship between sediment chemistry and biological effects (see Section 9.1, Exponent, 2003). While sediment chemistry may not be correlated with readily observable biological effects that does not mean that the elevated sediment chemistry levels are not impacting the benthic community. For example, the chemical pollutants may be affecting the biota in ways not measured or identified in this study. The triad uses all three lines of evidence because only one or two lines of evidence might fail to identify possible impairment. Each individual test for assessing sediment contamination has an inherent level of uncertainty associated with their application, but the uncertainty can be reduced by using all three of these tests. The integration of multiple tools using a weight-of –evidence approach has the potential to substantially reduce uncertainty associated with the assessment of contaminated sediment and will improve management decisions. The Regional Board's sediment quality triad analysis presented herein uses all three legs of the triad (sediment chemistry, toxicity, and benthic community).

Based on the results of the sediment quality triad lines of evidence, 14 of 30 stations sampled at the Shipyard Sediment Site are categorized as “likely”, which means it is likely that the CoPCs are adversely impacting the health of the benthic community (Table 16-1). The process used to assign the “low”, “moderate”, and “high” classifications to each line of evidence, and the “unlikely”, “possible”, and “likely” categories for the weight-of-evidence conclusions are described below.

The results presented in Table 16-1 are based on a comparative analysis using a set of reference stations that characterize the “Reference Condition” described in Section 15 of this Technical Report. This “Reference Condition” can be used to represent contemporary background chemical and biological characteristics of San Diego Bay and is reflective of conditions that would exist in the marine sediment in the absence of the Shipyard Sediment Site discharges. This condition reflects the presence of existing background anthropogenic levels of pollutants from non-shipyard related discharges (e.g., urban watershed loading in San Diego Bay), as well as natural variability in marine sediment toxicity and benthic community condition. A description of the Reference Condition, including a list of the reference stations, is provided in Section 15 of this Technical Report, Reference Sediment Quality Condition.

Table 16-1. Results of the Sediment Quality Triad Approach using the Reference Condition

Site	Station	Sediment Chemistry[1]	Toxicity[2]	Benthic Community[3]	Weight-of-Evidence Category[4]
NASSCO	NA01	High	Low	Low	Possible
	NA03	High	Low	Low	Possible
	NA04	High	Low	Low	Possible
	NA05	High	Low	Low	Possible
	NA06	High	Low	Low	Possible
	NA07	High	Low	Low	Possible
	NA09	High	Moderate	Low	Likely
	NA11	High	Moderate	Low	Likely
	NA12	Moderate	Moderate	Low	Possible
	NA15	High	Low	Low	Possible
	NA16	High	Moderate	Low	Likely
	NA17	High	Low	Low	Possible
	NA19	High	Moderate	Low	Likely
	NA20	Moderate	Low	Moderate	Likely
	NA22	High	Moderate	Moderate	Likely
BAE Systems (formerly Southwest Marine)	SW02	High	Low	Low	Possible
	SW03	High	Low	Low	Possible
	SW04	High	Low	Moderate	Likely
	SW08	High	Low	Low	Possible
	SW09	High	Low	Low	Possible
	SW11	High	Low	Low	Possible
	SW13	High	Moderate	Low	Likely
	SW15	High	Moderate	Low	Likely
	SW17	High	Moderate	Low	Likely
	SW18	High	Low	Low	Possible
	SW21	High	Low	Low	Possible
	SW22	High	Moderate	Low	Likely
	SW23	High	Moderate	Low	Likely
	SW25	High	Moderate	Low	Likely
	SW27	High	Moderate	Low	Likely

[1] Relative likelihood that the chemicals present in the sediment is adversely impacting organisms living in or on the sediment (i.e., benthic community).
[2] Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.
[3] Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.
[4] Relative likelihood (likely, possible, or unlikely) that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.

Prior to identification of the Reference Condition to represent contemporary background conditions in San Diego Bay, the Regional Board considered three other alternative pools: 1) the Regional Board's Final Reference Pool (RWQCB, 2003b) 2) the National Oceanic and Atmospheric Administration's (NOAA) Reference Pool, and 3) the San Diego Bay Council's Reference Pool. For comparison purposes, the three alternative reference pools, including their respective Triad results, are provided in the Appendix for Section 16 and Table 16-2, below. Documents submitted by NOAA and the San Diego Bay Council on this subject are also included in the Appendix for Section 16. The Regional Board used the Reference Condition described in Section 15 of this Technical Report over the three alternative reference pools because it:

- Most closely represents the pre-discharge condition at the Shipyard Sediment Site;
- Provides an adequate sample size for statistical analysis;
- Provides greater temporal and methodological comparability to the site data;
- Incorporates the natural variability in toxicity and benthic communities in San Diego Bay;
- Captures the range of fines content present at the Shipyard Sediment Site; and
- Provides reasonable protection of the benthic community from contaminant-induced degradation.

A comparison of the sediment quality triad results for each alternate reference pool is shown in Table 16-2 below. Note that the weight-of-evidence results for all four reference pools support the conclusion that it is "likely" that contaminants present in the Shipyard Sediment Site are adversely impacting the benthic community and can be used to identify extensive areas at the Shipyard Sediment Site that may require remediation or cleanup to protect or restore aquatic life beneficial uses. This should allay concerns expressed by some stakeholders that the Regional Board's "Reference Condition", described in Section 15, is not sufficiently free of pollution and that a more pristine reference pool is needed to adequately distinguish pollution effects at the Shipyard Sediment Site.

Table 16-2. Comparison of the Triad Results using the Reference Condition, Regional Board Background, NOAA Background, and San Diego Bay Council Background

Site	Station	Weight-of-Evidence Results[1]			
		Reference Condition[2]	Regional Board Background[2] (Final Reference Pool)	NOAA Background[3]	San Diego Bay Council Background[3, 4]
NASSCO	NA01	Possible	**Likely**	**Likely**	**Likely**
	NA03	Possible	**Likely**	**Likely**	**Likely**
	NA04	Possible	**Likely**	**Likely**	**Likely**
	NA05	Possible	**Likely**	Possible	**Likely**
	NA06	Possible	**Likely**	**Likely**	**Likely**
	NA07	Possible	**Likely**	**Likely**	**Likely**
	NA09	**Likely**	**Likely**	**Likely**	**Likely**
	NA11	**Likely**	**Likely**	**Likely**	**Likely**
	NA12	Possible	**Likely**	**Likely**	**Likely**
	NA15	Possible	**Likely**	Possible	**Likely**
	NA16	**Likely**	**Likely**	**Likely**	**Likely**
	NA17	Possible	**Likely**	**Likely**	**Likely**
	NA19	**Likely**	**Likely**	**Likely**	**Likely**
	NA20	Unlikely	**Likely**	Possible	**Likely**
	NA22	**Likely**	**Likely**	**Likely**	**Likely**
BAE Systems (formerly Southwest Marine)	SW02	Possible	**Likely**	Possible	**Likely**
	SW03	Possible	**Likely**	Possible	**Likely**
	SW04	**Likely**	**Likely**	**Likely**	**Likely**
	SW08	Possible	Possible	Possible	**Likely**
	SW09	Possible	**Likely**	Possible	**Likely**
	SW11	Possible	**Likely**	**Likely**	**Likely**
	SW13	**Likely**	**Likely**	Possible	**Likely**
	SW15	**Likely**	**Likely**	**Likely**	**Likely**
	SW17	**Likely**	**Likely**	**Likely**	**Likely**
	SW18	Possible	Possible	**Likely**	**Likely**
	SW21	Possible	**Likely**	Possible	**Likely**
	SW22	**Likely**	**Likely**	**Likely**	**Likely**
	SW23	**Likely**	**Likely**	**Likely**	**Likely**
	SW25	**Likely**	**Likely**	**Likely**	**Likely**
	SW27	**Likely**	**Likely**	**Likely**	**Likely**

[1] Relative likelihood that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.
[2] Sediment chemistry data for metals was grain size normalized.
[3] Sediment chemistry data for metals was not grain size normalized.
[4] Toxicity line of evidence only considered amphipod survival data.

16.2 Sediment Chemistry Ranking Criteria

The low, moderate, and high classifications assigned to the sediment chemistry line-of-evidence are determined by comparing the bulk sediment chemical concentrations from each site station to sediment quality guidelines (SQGs) and to Reference Condition as follows:

- **Sediment Quality Guidelines -** Sediment quality guidelines (SQGs) are reference values above which sediment pollutant concentrations could pose a significant threat to aquatic life and can be used to evaluate sediment chemistry data. SQGs are considered one of the most effective methods for attempting to relate sediment chemistry to observed toxic effects and determine whether contaminants are present in amounts that could cause or contribute to adverse effects (Long et al., 1995; Long et al., 1998). SQGs have been used by regulatory agencies, research institutions, and environmental organizations throughout the United States to identify contamination hot spots, characterize the suitability of dredge material for disposal, and establish goals for sediment cleanup and source control (Vidal and Bay, 2005). SQGs are often used as a tool to interpret chemical data from analyses of sediment, identify data gaps, and screen contaminants of potential concern. SQGs are helpful in determining whether marine sediment contaminants warrant further assessment or are at a level that requires no further evaluation.

  Several different approaches, based on empirical or causal correlative methodologies, have been developed for deriving SQG screening levels. Each of these approaches attempts to predict pollutant concentration levels that could result in adverse effects to benthic species, which are extrapolated to represent the entire aquatic community. Examples of empirical SQGs include the effects range–low and effects range–median (ERM) values, which are concentrations corresponding to the 10th and 50th percentiles of the distribution observed in toxic samples, respectively. (Vidal and Bay, 2005). Examples of causal SQGs include the equilibrium partitioning (EqP) approach which uses partitioning theory to relate the dry-weight sediment concentration of a particular chemical that causes an adverse biological effect to the equivalent free chemical concentration in pore water and to the concentration sorbed to sediment organic carbon or bound to sulfide. The theoretical causal resolution of chemical bioavailability in relation to chemical toxicity in different sediments differentiates equilibrium partitioning approaches from purely empirical correlative assessment methods. (U.S. EPA 1998d). Causal SQGs have a greater ability relative to empirical SQGs to determine the specific contaminants responsible for toxicity. However causal SQGs require more extensive data sets and published values are not available for many contaminants relative to empirical SQGs. By comparison, empirical SQGs can be calculated for a large number of contaminants and only require routine chemical analyses. (Vidal and Bay, 2005)

It is important to note that SQGs are not promulgated as regulatory sediment quality criteria or standards in California nor are they intended as cleanup or remediation targets (Buchman, 1999). The SQGs used to classify the Shipyard Sediment Site stations include: 1) Effects Range-Median (ERM) for metals (Long et al., 1998), 2) Consensus midrange effects concentration for PAHs and PCBs (Swartz, 1999; MacDonald et al., 2000), and 3) Sediment Quality Guideline Quotient (SQGQ) for chemical mixtures (Fairey et al., 2001).

- **Reference Condition** - A key step to evaluating each line-of-evidence comprising the sediment quality triad of data is to determine if there are statistically significant differences between a contaminated marine sediment site and reference station sites. To accomplish this it is necessary to specify the appropriate statistical procedure to estimate the level of confidence obtained when differentiating between reference and the contaminated marine sediment site conditions. The statistical procedure used by the Regional Board in the Shipyard Sediment Site investigation to identify stations where conditions are significantly different from the Reference Condition consisted of identifying station sample values outside boundary established by the 95% prediction limit (PL) reference pool of data for each contaminant of concern. The 95% PL allows a one-to-one comparison to be performed between a single Shipyard Sediment Site station and the pool of “Reference Condition” stations (Reference Pool). Although multiple comparisons are made to the Reference Pool prediction limits, the Regional Board made a decision to not correct for multiple comparisons so that the Shipyard Site/Reference comparisons would remain conservative and more protective. The 95% UPL for sediment chemistry values are provided in the Appendix for Section 16. The 95% PL for metals sediment chemistry are normalized for grain size. The fines to metals normalization process and 95% PL are described in the Appendix for Section 15.

The relative potential for adverse effects attributable to sediment chemistry is classified as low, moderate, or high based on comparisons made to published sediment quality guidelines where increasing weight is given by the number and magnitude of chemicals exceeding a threshold, similar to the method used by Long et al. (1998). The breakpoints in the ranking levels are established using best professional judgment (BPJ) and followed Long et al. (1998) and Fairey et al., (2001). The Regional Board’s decision process for sediment chemistry evaluation is outlined in Figure 16-1. The sediment chemistry line-of-evidence results and categorical rank for each shipyard station using the Reference Condition are shown in Table 16-3.

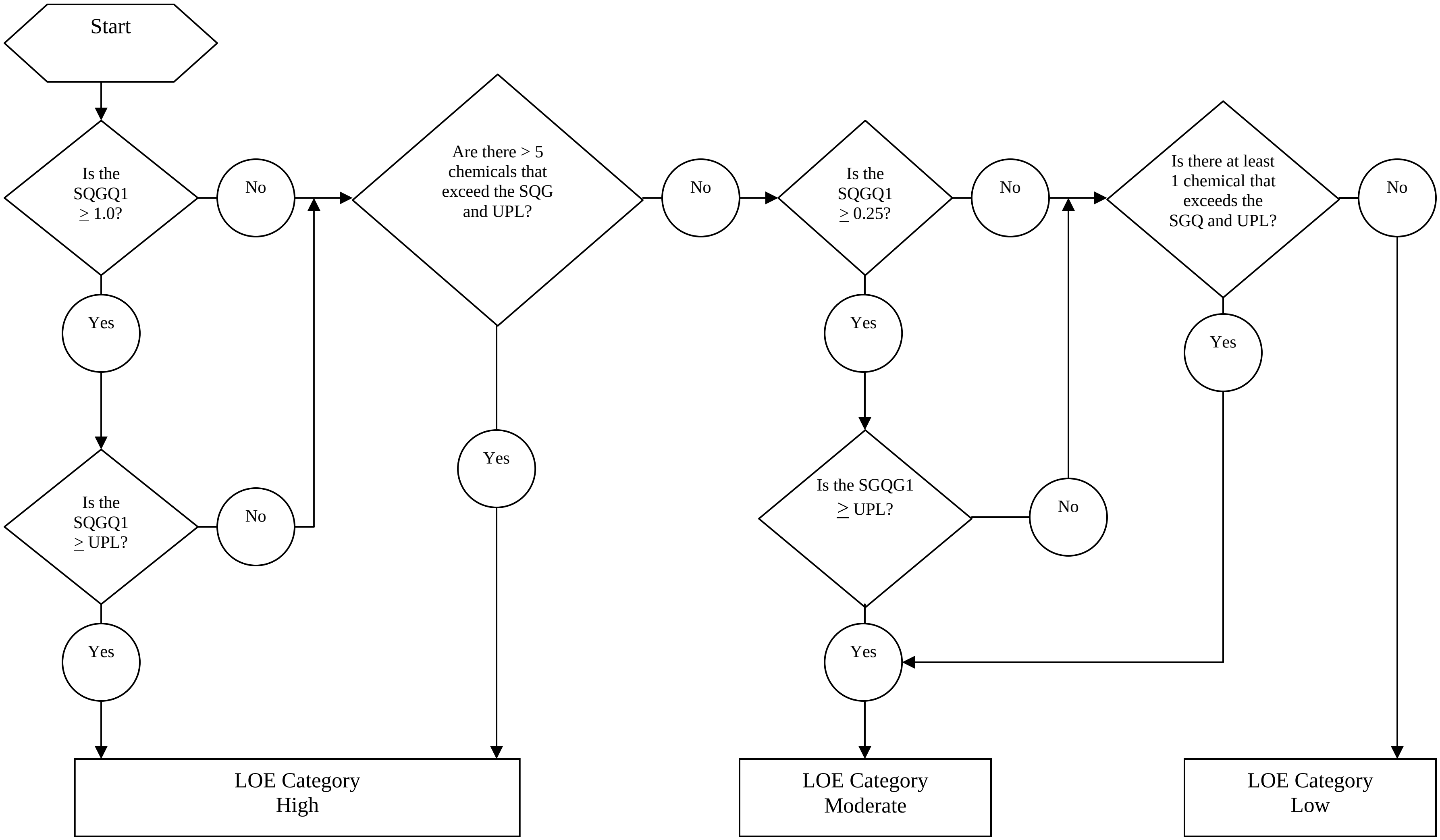

Figure 16-1. Flow Diagram for the Sediment Chemistry Ranking Criteria (low, moderate, and high)

Table 16-3. Sediment Chemistry Line-of-Evidence Results Using the Reference Condition

Site	Station	SQGQ1			SQGQ1 ≥ UPL	# Chemicals > SQG and UPL	LOE Category
		< 0.25	0.25 to 1.0	> 1.0			
NASSCO	NA01		X		Yes	9	**High**
	NA03		X		Yes	10	**High**
	NA04		X		Yes	9	**High**
	NA05		X		Yes	4	**High**
	NA06		X		Yes	11	**High**
	NA07		X		Yes	10	**High**
	NA09		X		Yes	9	**High**
	NA11		X		Yes	7	**High**
	NA12		X		Yes	5	**Moderate**
	NA15		X		Yes	9	**High**
	NA16		X		Yes	10	**High**
	NA17			X	Yes	13	**High**
	NA19			X	Yes	11	**High**
	NA20		X		Yes	6	**Moderate**
	NA22		X		Yes	8	**High**
BAE Systems (formerly Southwest Marine)	SW02			X	Yes	17	**High**
	SW03		X		Yes	10	**High**
	SW04			X	Yes	17	**High**
	SW08			X	Yes	17	**High**
	SW09			X	Yes	15	**High**
	SW11		X		Yes	8	**High**
	SW13			X	Yes	16	**High**
	SW15		X		Yes	9	**High**
	SW17		X		Yes	11	**High**
	SW18		X		Yes	7	**High**
	SW21			X	Yes	13	**High**
	SW22			X	Yes	10	**High**
	SW23			X	Yes	13	**High**
	SW25		X		Yes	10	**High**
	SW27		X		Yes	7	**High**

The sediment chemistry ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). The criteria were developed by SCCWRP, U.S. Navy, and the Regional Board with input from California Department of Fish and Game (DFG), U.S. Fish and Wildlife Service (U.S. FWS), California Department of Toxics Substance Control (DTSC), and National Oceanic and Atmospheric Administration (NOAA); collectively referred to as the Natural Resource Trustee Agencies (NRTAs), non governmental environmental groups, San Diego Unified Port District (SDUPD), and the City of San Diego (City).

The low, moderate, and high sediment chemistry ranking criteria are based on the following two key assumptions (SCCWRP and U.S. Navy, 2005b):

1. A Shipyard Sediment Site sample station is ranked as having a low likelihood of impact from sediment contaminants of concern when all chemicals at a station are less than relatively low SQGs and less than the established Reference Condition; and
2. A Shipyard Sediment Site sample station is ranked as having a high likelihood of impact from sediment contaminants of concern when many of the chemicals at a station exceed a relatively high SQG, and exceed the Reference Condition sediment chemistry levels.

The specific sediment chemistry line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 16-1 of this report. The same sediment chemistry ranking criteria from the SCCWRP and U.S. Navy (2005b) report is used to evaluate the sediment chemistry data to the Shipyard Sediment Site sample stations.

Low Potential for Adverse Effects: The mean SQGQ1 is less than 0.25 or all chemicals were less than the 95% predictive limit calculated from the Reference Pool. Additionally, there must not be any single chemical that exceeded either its SQG or Reference Pool predictive limit value whichever was higher. To meet this category, all chemicals present at the site station, either individually or when summed, must be lower than a relatively low SQG and below the Reference Condition.

Moderate Potential for Adverse Effects: The mean SQGQ1 is between 0.25 and 1.0 and greater than the 95% predictive limit calculated from the Reference Pool. Additionally, a station is classified under this category if there are five or less individual chemicals that exceed their respective SQG or Reference Pool predictive limit, whichever is higher. To meet this category, some (five or less) chemicals either individually or when summed exceed a moderate level SQG and/or the Reference Condition.

High Potential for Adverse Effects: The mean SQGQ1 for all chemicals is greater than or equal to 1.0 and is greater than the 95% predictive limit calculated from the Reference Pool. This category is also assigned if more than five chemicals exceed their individual SQG or the Reference Condition, whichever is higher. To meet this category, the Reference Condition as well as a relatively high SQG is exceeded when chemicals are considered as a group, or there are at least six individual chemicals exceeding a SQG or Reference Condition.

To determine the likelihood of impairment (likely, possible, or unlikely) in the overall weight of evidence, each line of evidence ranking (low, moderate, or high) is put into the Weight-of-Evidence Analysis framework described in Section 16.5 below.

16.3 Toxicity Ranking Criteria

The low, moderate, and high classifications assigned to the toxicity line-of-evidence are determined by comparing the results of the three toxicity tests to their negative controls[106] and to the Reference Condition described in Section 15 of this Technical Report:

- **Negative Controls** - The first key step in the toxicity line-of-evidence is to determine whether there are statistically significant differences between toxicity observed at the Shipyard Sediment Site and toxicity observed in the laboratory control condition. Three types of sediment toxicity tests were conducted at each Shipyard Site station: (1) 10-day amphipod survival test using *Eohaustorius estuarius* exposed to whole sediment, (2) 48-hour bivalve larva development test using the mussel *Mytilus galloprovincialis* exposed to whole sediment at the sediment-water interface, and (3) 40-minute echinoderm egg fertilization test using the purple sea urchin Strongylocentrotus purpuratus exposed to sediment pore water. The results of these toxicity tests were compared statistically to their respective negative controls using a one-tailed Student t-test ($\alpha = 0.05$).
- **Reference Condition** - The second key step in the toxicity line-of-evidence is to determine whether there are statistically significant differences between toxicity observed at the Shipyard Site and toxicity observed at the Reference Condition. The statistical procedure used to identify these differences consisted of the 95% lower prediction limit (LPL). The 95% PL allows a one-to-one comparison to be performed between a single Shipyard Site station and a pool of reference stations. The 95% PL computes a single threshold value for each toxicity test in the Reference station pool (e.g., amphipod survival) from which each Shipyard Site station toxicity result is compared. Although multiple comparisons are made to the Reference Condition prediction limits, the Regional Board made a decision to not correct for multiple comparisons so that the Shipyard Site/reference comparisons would be more conservative and protective. The 95% LPL for the three toxicity tests are shown in the Appendix for Section 16 and Table 16-4.

Similar to the chemistry line-of-evidence, the sediment toxicity ranking method employed a semi-quantitative assessment of the data that reflected both the presence and magnitude of toxicity. The category ranking criteria for sediment toxicity are summarized below and depicted in Figure 16-2. A summary of the toxicity results by sampling location and the 95% LPL is

[106] The term “controls” refers to a treatment in a toxicity test that duplicates all of the conditions of the exposure treatments but contains no test material. The control is used to determine the absence of toxicity of basic test conditions (e.g. health of test organisms, quality of dilution water). “Control sediment” is sediment that is (1) essentially free of contaminants, (2) used routinely to assess the acceptability of a test, and (3) not necessarily collected near the site of concern. Control sediment provides a measure of test acceptability, evidence of test organism health, and a basis for interpreting data obtained from test sediments. “Negative Control” is a type of control used to determine the inherent background effects in the toxicity test, such as effects related to the health of the test organisms and the quality of the dilution water. It provides a baseline and a point of correction for interpreting the sediment toxicity test results.

presented in Table 16-4. The toxicity line-of-evidence results for each shipyard station using the Reference Condition comparison are depicted in Table 16-5.

Table 16-4. Comparison of NASSCO and BAE Systems Toxicity Data to the Reference Pool 95 Percent Lower Prediction Limit (LPL)

Site	Station	Amphipod Survival (95% LPL = 72.9%)	Urchin Fertilization (95% LPL = 41.9%)	Bivalve Development (95% LPL = 37.4%)
NASSCO	NA01	80	86	49
	NA03	84	84	94
	NA04	80	88	84
	NA05	89	95	94
	NA06	78	103	74
	NA07	74	102	88
	NA09	88	99	**1**
	NA11	**70**	101	80
	NA12	82	89	**15**
	NA15	97	88	93
	NA16	90	84	**3**
	NA17	95	88	80
	NA19	89	72	**2**
	NA20	90	78	80
	NA22	95	111	**2**
BAE Systems (formerly Southwest Marine)	SW02	88	103	85
	SW03	92	103	88
	SW04	94	108	63
	SW08	91	103	93
	SW09	88	100	85
	SW11	77	89	83
	SW13	92	99	**28**
	SW15	92	103	**9**
	SW17	95	96	**16**
	SW18	74	83	64
	SW21	91	102	67
	SW22	90	104	**1**
	SW23	91	107	**16**
	SW25	86	103	**10**
	SW27	73	91	**22**

NOTES: Toxicity values less than the 95% lower prediction limit values are bold faced and shaded.

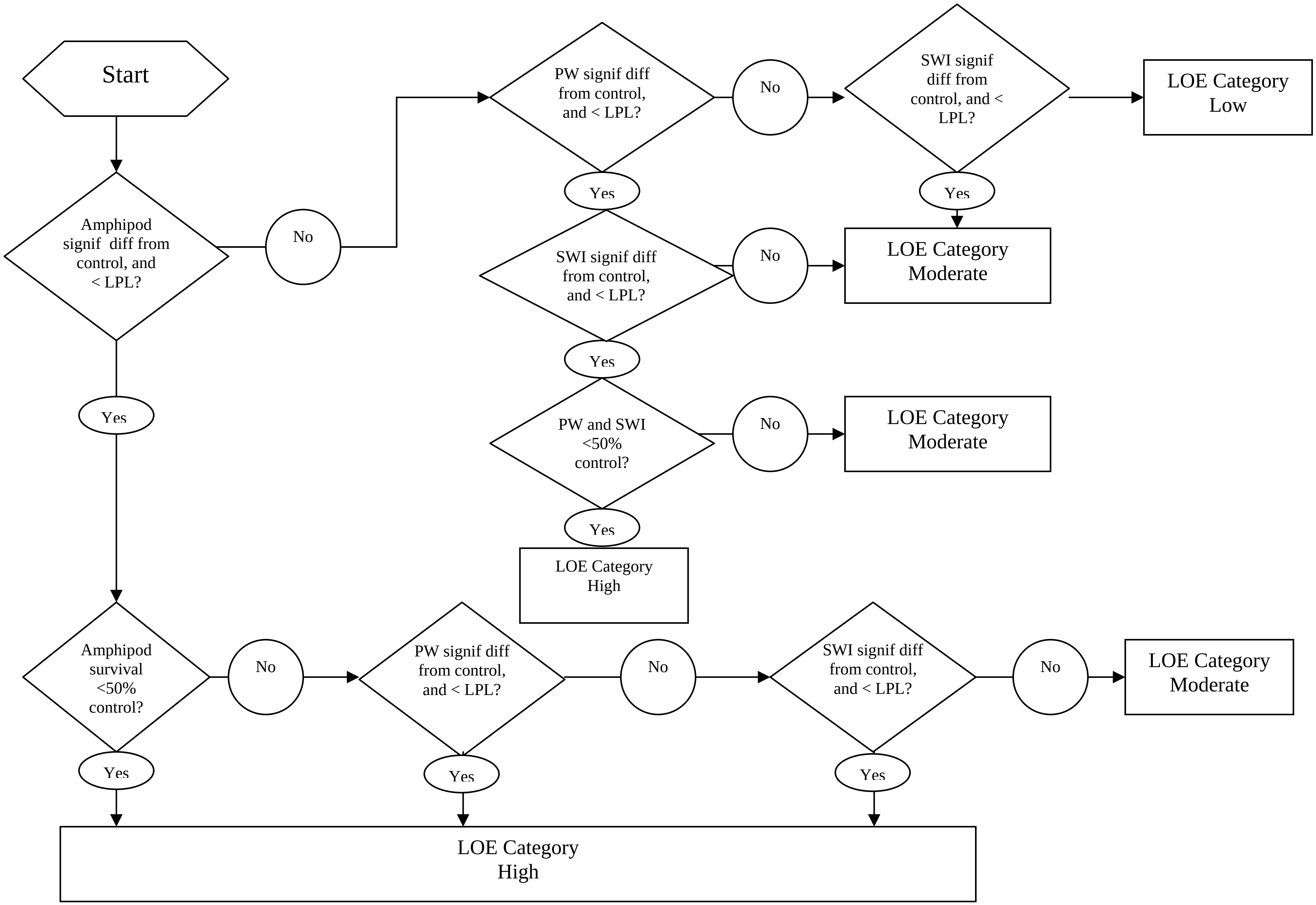

Figure 16-2. Toxicity Lines of Evidence

The toxicity ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). The criteria were developed by SCCWRP, U.S. Navy, and the Regional Board; with input from NRTAs, non-governmental environmental groups, Port, and the City of San Diego.

The low, moderate, and high toxicity ranking criteria are based on the following five key assumptions (SCCWRP and U.S. Navy, 2005b):

1. Toxic effects at Shipyard Sediment Site sample stations are classified as low or none when the results of all three toxicity tests were not significantly different from their controls or they had a statistically lower level of toxicity than observed at the Reference Condition sample stations;
2. The presence of significant toxicity in any one test was sufficient to classify a Shipyard Sediment Site sample station as moderately toxic. The three toxicity tests were given equal weight for classifying a sample station as moderately toxic;
3. If amphipod survival is less than 50% and significantly different from the control and Reference, a high rank of sediment toxicity was justified;
4. Toxic effects at Shipyard Sediment Site sample stations are classified as high when both of the sublethal toxicity tests measured a greater level of toxicity than the Reference Condition sample stations; and
5. The amphipod toxicity test result is given greater weight for the high toxicity category because the acute survival endpoint of this test was assumed to have a higher degree of association with ecological impacts than either the urchin fertilization or bivalve development tests. The sea urchin fertilization and bivalve embryo development test results are given less weight because these are sublethal critical life stage tests that are more susceptible to confounding factors, and their association with ecological impacts is less certain.

The toxicity line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 16-2. The same toxicity ranking criteria from the SCCWRP and U.S. Navy (2005b) report were used to evaluate the sediment toxicity data from the Shipyard Sediment Site investigation.

Low Toxicity: Toxic effects are classified as low or none when results of all three bioassays were not significantly different from their controls or they have a statistically lower level of toxicity than observed at the Reference Condition sample stations.

Moderate Toxicity: Toxic effects are classified as moderately toxic if any one of the bioassay results is statistically different from its control and was less than the Reference Condition. Additionally, it is required for amphipod survival to have been greater than 50%, regardless of the result relative to controls or the Reference Condition.

High Toxicity: Toxic effects are classified as highly toxic when any one of the following criteria are met:

1. If survival of amphipods at a station is less than 50% and is statistically different than controls and statistically less than the Reference Condition sample stations.
2. If the amphipod test together with any one of the other bioassays both has a result that is statistically different from control and is statistically less than the Reference Condition sample stations.
3. If both the porewater and sediment-water interface test results are less than 50% of the control values and are statistically less than the controls and the Reference Condition sample stations.

To determine the likelihood of impairment (likely, possible, or unlikely) in the overall weight of evidence, each line of evidence ranking (low, moderate, or high) is put into the Weight-of-Evidence Analysis framework described in Section 16.5 below.

Table 16-5. Toxicity Line-of-Evidence Results using the Reference Condition

Station	Amphipod Survival			Urchin Fertilization			Bivalve Development			LOE Category
	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	
NA01	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA03	No	No	No	Yes	No	No	No	No	No	**Low**
NA04	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA05	Yes	No	No	No	No	No	No	No	No	**Low**
NA06	Yes	No	No	No	No	No	No	No	No	**Low**
NA07	Yes	No	No	No	No	No	No	No	No	**Low**
NA09	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
NA11	Yes	Yes	No	No	No	No	No	No	No	**Moderate**
NA12	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA15	No	No	No	Yes	No	No	No	No	No	**Low**
NA16	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA17	No	No	No	Yes	No	No	Yes	No	No	**Low**
NA19	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA20	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA22	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
SW02	Yes	No	No	No	No	No	No	No	No	**Low**
SW03	No	No	No	No	No	No	Yes	No	No	**Low**
SW04	No	No	No	Yes	No	No	Yes	No	No	**Low**
SW08	Yes	No	No	No	No	No	Yes	No	No	**Low**
SW09	No	No	No	No	No	No	Yes	No	No	**Low**
SW11	Yes	No	No	Yes	No	No	No	No	No	**Low**
SW13	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW15	No	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW17	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
SW18	No	No	No	Yes	No	No	Yes	No	No	**Low**
SW21	Yes	No	No	No	No	No	No	No	No	**Low**
SW22	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW23	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
SW25	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW27	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**

16.4 Benthic Community Ranking Criteria

The low, moderate, and high potential for benthic community degradation classifications used in the benthic community line-of-evidence were determined by comparing the benthic community structure indices at each Shipyard Sediment Site station to the thresholds developed for the Bight'98 Benthic Response Index for Embayments (BRI-E) (Ranasinghe et al., 2003) and to the Reference Condition sample stations:

- **Benthic Response Index for Embayments –** The BRI-E was developed by SCCWRP as a screening tool to discriminate between disturbed and undisturbed benthic communities in Southern California embayments, such as San Diego Bay. In order to give BRI-E values an ecological context and facilitate their interpretation and use for evaluation of benthic community condition, a reference threshold and four thresholds of response were defined by SCCWRP (Table 16-6). The reference threshold is defined as a value toward the upper end of the range of index values of samples taken at sites that had minimal known anthropogenic influence. The other four thresholds (Response Levels 1, 2, 3, and 4) involved defining levels of deviation from the reference condition. These thresholds are based upon a determination of the index values, above which species, or groups of species, no longer occurred along the pollution gradient.

Table 16-6. Characterization, Definition and BRI-E Thresholds for Levels of Benthic Community Condition

Level	Definition for Bays	BRI-E Threshold
Reference		< 31
Response Level 1	> 5% of reference species lost	31 to 42
Response Level 2	> 25% of reference species lost	42 to 53
Response Level 3	> 50% of reference species lost	53 to 73
Response Level 4	> 80% of reference species lost	> 73

(Ranasinghe et al., 2003)

- **Reference Condition –** Four metrics were used to assess the benthic community structure: (1) Total abundance – the total number of individuals identified in each replicate sample, (2) Total taxa richness – the total number of distinct taxa identified in each replicate, (3) Shannon-Weiner Diversity Index – a measure of both the number of species and the distribution of individuals among species; higher values indicate that more species are present or that individuals are more evenly distributed among species, and (4) BRI-E – a quantitative index that measures the condition of marine and estuarine benthic communities by reducing complex biological data to single values. A key step in the benthic community line-of-evidence is to determine whether there are statistically significant differences between the benthic community structures observed at the site and the benthic community structure observed at the Reference Condition sample stations using the four metrics described above. The statistical procedure used in the Shipyard Sediment Site investigation to identify these differences consisted of the 95% LPL for total abundance, # of Taxa, and Shannon-Weiner Diversity index. A 95% UPL was used for the BRI-E. The 95% PL computes a single threshold value for each benthic community metric in the Reference Condition (e.g., total abundance) from which each site station metric result is compared. Although multiple comparisons are made to the Reference Condition sample stations, the Regional Board made a decision to not correct for multiple comparisons so that the Shipyard Site/Reference comparisons would be more conservative and protective. The 95% LPL (and UPL for BRI-E) prediction limits for the four benthic community metrics are shown in Table 16-7.

Table 16-7. Comparison of Benthic Community Metrics Data from NASSCO and BAE Systems Stations to the Reference Pool 95 Percent Prediction Limits

Site	Station	BRI (95% UPL = 57.7)	Abundance* (95% LPL = 239)	# Taxa* (95% LPL = 22)	S-W Diversity (95% LPL = 1.8)
NASSCO	NA01	42.2	447	33	2.8
	NA03	45.5	492	40	3.0
	NA04	49.6	285	25	2.5
	NA05	44.4	569	35	2.4
	NA06	54.4	611	37	2.7
	NA07	44.6	475	43	3.0
	NA09	51.1	862	44	2.6
	NA11	46.0	604	33	2.4
	NA12	42.6	538	37	2.7
	NA15	51.0	306	26	2.3
	NA16	48.0	522	33	2.6
	NA17	55.3	418	33	2.7
	NA19	46.7	828	43	2.7
	NA20	54.0	412	**22**	2.3
	NA22	51.6	**107**	**15**	2.2
BAE Systems (formerly Southwest Marine)	SW02	52.1	976	39	2.4
	SW03	49.9	361	31	2.8
	SW04	41.1	3,175	36	**1.6**
	SW08	41.5	2,457	41	2.4
	SW09	53.2	572	39	2.7
	SW11	42.4	777	44	2.9
	SW13	43.6	742	53	3.2
	SW15	37.8	806	59	3.1
	SW17	45.7	621	30	2.4
	SW18	39.5	829	42	2.8
	SW21	53.2	315	24	2.4
	SW22	55.1	363	26	2.4
	SW23	50.0	316	27	2.6
	SW25	41.3	611	40	2.8
	SW27	42.9	927	48	2.9

NOTES:

95% upper prediction limit values presented below each constituent in ( ).

* Values were derived from natural log transformed data.

For the BRI, concentrations greater than the 95% upper prediction limit value are bold faced and shaded.

For the abundance, # taxa, and S-W diversity metrics, concentrations lower than their respective 95% upper prediction limit values are bold faced and shaded.

The benthic community ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). SCCWRP, U.S. Navy, and the Regional Board developed the criteria with input from NRTAs, non-governmental environmental groups, the Port, and the City of San Diego.

The BRI-E threshold scores evidence are weighed higher because: (1) they are a comprehensive measure of benthic community health developed specifically for bays and harbors in Southern California, (2) the indices remove much of the subjectivity associated with interpreting the benthic community structure data, and (3) the indices provide a simple means of communicating complex benthic community structure data to the public and regulatory managers. The category ranking criteria for benthic community composition is depicted in Figure 16-3. The benthic community line-of-evidence results for each Shipyard Sediment Site station using the Reference Condition comparison are shown in Table 16-8.

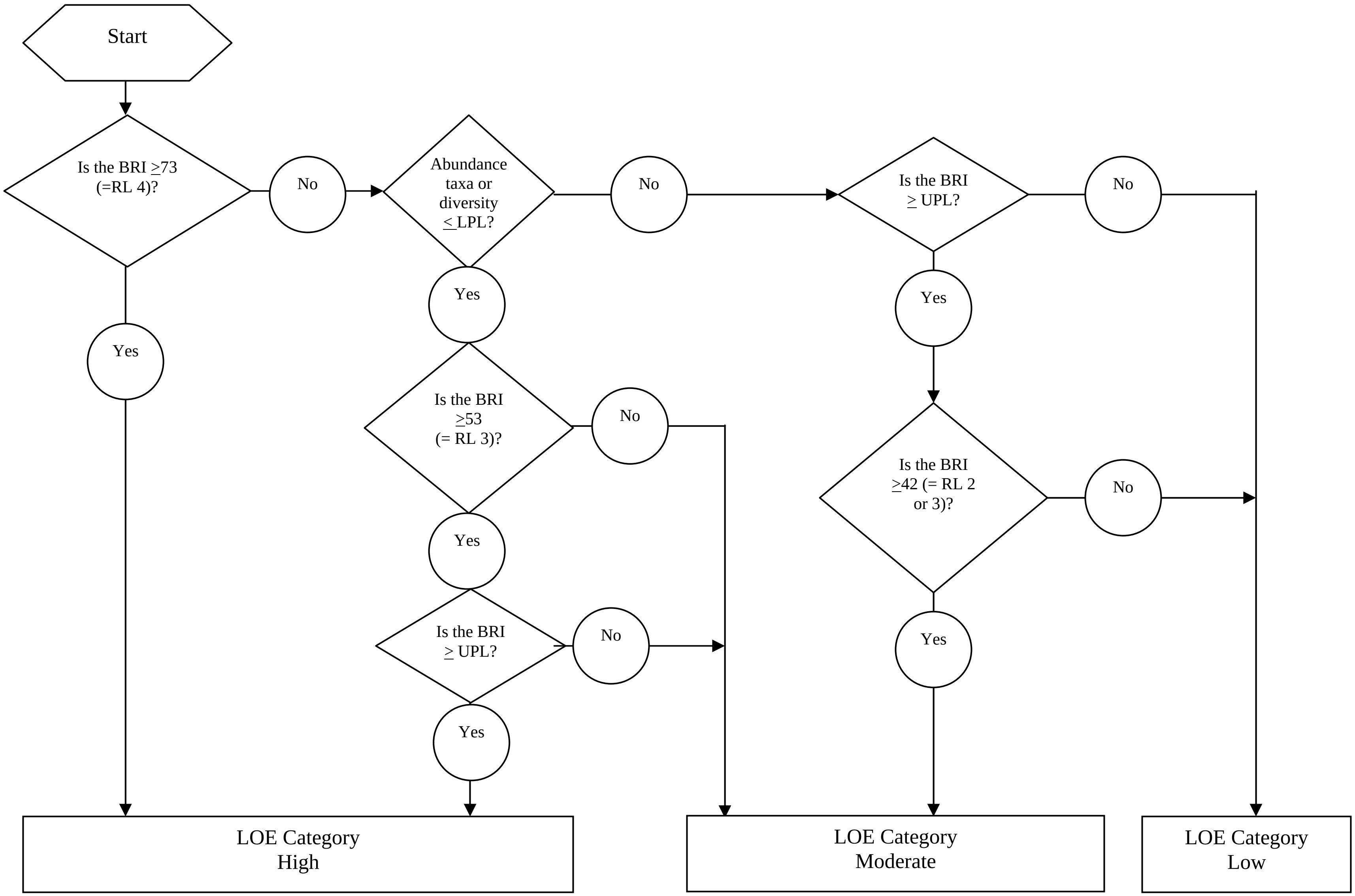

Figure 16-3. Benthic Community Lines of Evidence Characteristics

Table 16-8. Benthic Community Line-of-Evidence Results Using the Reference Condition Comparison

Station	Benthic Response Index				Abundance	# Taxa	S-W Diversity	LOE Category
	≥ 73	≥ 53	≥ 42	≥ 95% UPL	≤ 95% LPL	≤ 95% LPL	≤ 95% LPL	
NA01	No	No	Yes	No	No	No	No	**Low**
NA03	No	No	Yes	No	No	No	No	**Low**
NA04	No	No	Yes	No	No	No	No	**Low**
NA05	No	No	Yes	No	No	No	No	**Low**
NA06	No	Yes	Yes	No	No	No	No	**Low**
NA07	No	No	Yes	No	No	No	No	**Low**
NA09	No	No	Yes	No	No	No	No	**Low**
NA11	No	No	Yes	No	No	No	No	**Low**
NA12	No	No	Yes	No	No	No	No	**Low**
NA15	No	No	Yes	No	No	No	No	**Low**
NA16	No	No	Yes	No	No	No	No	**Low**
NA17	No	Yes	Yes	No	No	No	No	**Low**
NA19	No	No	Yes	No	No	No	No	**Low**
NA20	No	Yes	Yes	No	No	Yes	No	**Moderate**
NA22	No	No	Yes	No	Yes	Yes	No	**Moderate**
SW02	No	No	Yes	No	No	No	No	**Low**
SW03	No	No	Yes	No	No	No	No	**Low**
SW04	No	No	No	No	No	No	Yes	**Moderate**
SW08	No	No	No	No	No	No	No	**Low**
SW09	No	Yes	Yes	No	No	No	No	**Low**
SW11	No	No	Yes	No	No	No	No	**Low**
SW13	No	No	Yes	No	No	No	No	**Low**
SW15	No	No	No	No	No	No	No	**Low**
SW17	No	No	Yes	No	No	No	No	**Low**
SW18	No	No	No	No	No	No	No	**Low**
SW21	No	Yes	Yes	No	No	No	No	**Low**
SW22	No	Yes	Yes	No	No	No	No	**Low**
SW23	No	No	Yes	No	No	No	No	**Low**
SW25	No	No	No	No	No	No	No	**Low**
SW27	No	No	Yes	No	No	No	No	**Low**

The low, moderate, and high ranking benthic community health classification criteria are based on the following two key assumptions (SCCWRP and U.S. Navy, 2005b):

- The assumption is made that no, or a low degree of benthic community degradation is present when the station BRI is Response Level 1 (< RL 2) or is statistically similar to the Reference Condition; and
- A high degree of benthic community degradation at a station is assumed to be present at BRI Response Levels (RLs) greater than 3 or when other indicators also show benthic community structure impacts.

The benthic community structure line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 16-3 of this report. The same ranking criteria from the SCCWRP and U.S. Navy (2005b) report are used to evaluate the benthic community indices from the Shipyard Sediment Site investigation.

Low Degree of Benthic Community Degradation: Benthic community degradation at each station is classified as none or a low if the BRI RL is less than 2 and when abundance, number of taxa, and the Shannon-Weiner Diversity Index are all statistically similar to the Reference Condition.

Moderate Degree of Benthic Community Degradation: The benthic community is classified as moderately degraded at stations exhibiting a BRI RL 2 or 3 and is statistically greater degradation than the Reference Condition, or, if any one of the other benthic community metrics is below the 95% PL established by the Reference Condition.

High Degree of Benthic Community Degradation: The benthic community is classified as highly degraded at stations with a BRI greater than RL 3. The benthic community is also classified as highly degraded at stations with BRI RL 2, the results are statistically greater than Reference Condition, and at least one of the other benthic community metrics is below the 95% PL established by the Reference Condition.

To determine the likelihood of benthic community impairment (likely, possible, or unlikely), each line of evidence ranking (low, moderate, or high) is put into the Weight-of-Evidence Analysis framework described in Section 16.5 below.

16.5 Weight-of-Evidence Criteria

The classification results for the three lines of evidence comprising the sediment quality triad of data are integrated into an overall weight-of-evidence evaluation that focuses on identifying the likelihood that the health of the benthic community is adversely impacted at a given station due to the presence of chemicals of concern in the sediment. This evaluation follows the general principles of the "Sediment Quality Triad Approach" described in a U.S. EPA compendium of "scientifically valid and accepted methods" used to assess sediment quality (U.S. EPA, 1992a).

Three categories are used to describe the overall likelihood of impairment at each Shipyard Sediment Site station: "unlikely," "possible," and "likely." These categories are assigned to each Shipyard Sediment Site station based on the potential combinations of the low, moderate, and high classifications of impairment for each previously described line-of-evidence in this Section. For example, a station with a "high" classification for sediment chemistry, toxicity, and benthic community would indicate that it is "likely" that the benthic community is adversely impacted. The framework used to interpret the various combinations is shown in Table 16-9 below, and is based on the consideration of four key elements as described in *"Sediment Assessment Study for the Mouth of Chollas and Paleta Creek, Phase 1 Final Report, May 2005"* (SCCWRP and U.S. Navy, 2005b).

- Level of confidence or weight given to the individual line of evidence
- Whether the line of evidence indicates there is an effect
- Magnitude or consistency of the effect
- Concurrence among the various lines of evidence.

The weight-of-evidence results for each Shipyard Sediment Site station are presented above and are summarized in Table 16-1.

Table 16-9. Weight-of-Evidence Analysis Framework for the Aquatic Life Impairment Assessment

Sediment Chemistry [1]	Toxicity [2]	Benthic Community [3]	Relative Likelihood of Benthic Community Impairment [4]
High	High	High	Likely
High	High	Moderate	
High	Moderate	High	
Moderate	High	High	
High	High	Low	
High	Low	High	
High	Moderate	Moderate	
Moderate	High	Moderate	
Moderate	Moderate	High	
Moderate	Moderate	Moderate	
High	Moderate	Low	
High	Low	Moderate	
Moderate	High	Low	
Moderate	Low	High	
Moderate	Moderate	Low	Possible
Moderate	Low	Moderate	
High	Low	Low	
Low	High	High	Unlikely
Low	High	Moderate	
Low	Moderate	High	
Low	Moderate	Moderate	
Low	Low	High	
Low	High	Low	
Low	Low	Moderate	
Low	Moderate	Low	
Moderate	Low	Low	
Low	Low	Low	

[1] Relative likelihood that the contaminants present in the sediment is adversely impacting organisms living in or on the sediment (i.e., benthic community).

[2] Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.

[3] Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.

[4] Relative likelihood that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.

17. Finding 17: Bioaccumulation

The Regional Board evaluated initial laboratory bioaccumulation test data to ascertain the bioaccumulation potential of the sediment chemical~~s~~ pollutants at the Shipyard Sediment Site. ~~The bioaccumulation tests involved the exposure of the clam *Macoma nasuta* to site sediments for 28 days using the protocols specified by ASTM. *Macoma nasuta* was selected as the test species for the initial bioaccumulation testing because it is native to the West Coast and actively ingests surface sediments (likely to be the most direct route of exposure to pollutants that accumulate in tissues).~~ Examination of laboratory test data on the chemical pollutant concentrations in tissue of the clam (*Macoma nasuta*) ~~tissue~~ relative to the pollutant concentrations in sediment indicates that bioaccumulation of chemical pollutants is occurring at the Shipyard Sediment Site. The data indicates for several chemical pollutants that concentrations in *Macoma nasuta* tissue increase in proportion to as chemical pollutant concentrations in sediment increase. Statistically significant relationships were found for arsenic, copper, lead, mercury, zinc, TBT, total PCBs, and high molecular weight polynuclear aromatic hydrocarbons (HPAHs). These chemical~~s~~ pollutants have a bioaccumulation potential at the Shipyard Sediment Site and are therefore considered bioavailable to benthic organisms. No statistically significant relationships were found for cadmium, chromium, nickel, selenium, silver, or PCTs.

17.1 Bioaccumulation Analyses

Sediment bioaccumulation tests were conducted to evaluate the bioaccumulation potential of the chemical pollutants present in sediment at the Shipyard Sediment Site and the degree to which these chemicals may enter the aquatic food web (Exponent, 2001a, 2002). The bioaccumulation tests involved the exposure of the clam *Macoma nasuta* to site and reference sediment for 28 days using the protocols specified by ASTM (2000). *Macoma* was selected as the test species for the bioaccumulation tests because it is native to the West Coast and actively ingests surface sediment (likely to be the most direct route of exposure to contaminants that accumulate in tissues). Bioaccumulation tests were conducted using sediment collected from four stations in the NASSCO leasehold (NA06, NA11, NA12, NA20), five stations in the BAE Systems (formerly Southwest Marine) leasehold (SW04, SW08, SW13, SW21, and SW28) and at five reference stations located in San Diego Bay (2441, 2433, 2440, 2231, and 2243). The site stations were positioned along a gradient of expected sediment concentrations of potentially bioaccumulative substances.

Evaluation of the chemical pollutant concentrations in *Macoma* tissue relative to the chemical pollutant concentrations in the sediment indicates that bioaccumulation of chemicals is occurring at the Shipyard Sediment Site (Exponent, 2003). For many chemical pollutants, concentrations in tissue increase as chemical pollutant concentrations in sediment increases, as shown in the regression plots provided in the Appendix for Section 17 of this Technical Report. Statistically significant tissue:sediment relationships (at $p = 0.05$) were found for arsenic, copper, lead, mercury, zinc, tributyltin (TBT), total polychlorinated biphenyls (PCBs), and high molecular weight polynuclear aromatic hydrocarbons (HPAHs). These chemical pollutants have a bioaccumulation potential at the Shipyard Sediment Site and are therefore considered bioavailable to benthic organisms. It should be noted, however, that the relationships for arsenic and zinc, although statistically significant, are subject to some uncertainty because each are controlled by a single data point. No statistically significant relationships (at $p = 0.05$) were found for cadmium, chromium, nickel, selenium, silver, or polychlorinated terphenyls (PCTs).

18. Finding 18: Pore Water

The Regional Board evaluated the chemistry of pore water, the water occupying the spaces between sediment particles, at the Shipyard Sediment Site to determine compliance with California Toxics Rule (CTR) water quality criteria and the potential risks to the benthic community from chemical pollutants present in the sediment. Pore water chemistry concentrations at the site were compared to water quality criteria established in the California Toxics Rule contained in 40 CFR 131.38. Comparisons were made to the CTR saltwater quality criterion continuous concentration, which is the highest concentration of a pollutant to which marine aquatic life can be exposed for an extended period of time without deleterious effects. Of the 12 site stations sampled for pore water (SW02 was excluded due to the presence of some suspended material remaining after centrifugation), 12 stations exceeded the copper CTR value, 6 stations exceeded the lead CTR value, and 12 stations exceeded the total PCBs CTR value. Although the comparisons to the CTR criteria identified several pollutants for which measured pore water concentrations are above levels of concern, the measured pore water concentrations may be biased high due to the possible presence of very fine suspended or colloidal material in the pore water samples that could not be removed by centrifugation. The pore water samples collected at the Shipyard Sediment Site were not filtered (in accordance with EPA guidance) and were reported as total concentrations, whereas the CTR values are filtered and are reported as dissolved fractions.

Comparison of Pore Water Concentrations at the Shipyard Sediment Site to CTR Water Quality Criteria

Station	Metals and PCBs (ug/L)								
	As	Cd	Cr (VI)	Cu	Pb	Ni	Se	Zn	PCBs (sum of homologs)
NA01	19	0.05	25	**14**	5.2	2.3	5.2	23	**68**
NA06	9.1	0.05	25	**33**	**12**	2.2	2.5	44	**200**
NA13	12	0.05	25	**14**	6.5	2.5	2.5	30	**56**
NA16	17	0.05	25	**22**	**9**	2.7	2.5	33	**94**
NA17	20	0.05	25	**23**	7	2.9	2.5	32	**84**
SW01	6.1	0.05	25	**17**	6.6	3	2.5	22	**500**
SW02 (outlier)	11	4.2	25	**390**	**120**	37	6.1	**610**	**51,600**
SW04	15	0.05	25	**55**	**20**	3.3	2.5	60	**600**
SW08	9.9	0.05	25	**33**	**12**	2	2.5	34	**520**
SW12	19	0.05	25	**17**	7.1	2.8	2.5	32	**80**
SW24	10	0.05	25	**25**	**9.8**	2.6	2.5	37	**670**
SW25	17	0.05	25	**28**	**13**	2.9	2.5	42	**180**
SW28	9	0.05	25	**19**	7.5	2.4	2.5	31	**290**

Note: Boxed and shaded values for Shipyard Sediment Site locations exceed CTR water quality criteria.

18.1 Pore Water

Pore water, the water occupying the spaces between sediment particles, was evaluated to determine compliance with California Toxics Rule water quality criteria and the potential risks to the benthic community from chemical pollutants present in the sediment at the Shipyard Sediment Site. Pore water is considered one of several key exposure routes for contaminants to benthic organisms associated with sediment (Chapman et al., 2001; U.S. EPA, 1994). Other routes of exposure include sediment ingestion and overlying water. A key advantage of analyzing pore water is that the measured concentrations can be compared to water quality criteria to identify potential risks to the benthic community. A direct comparison can be made between pore water concentrations and water quality criteria because available data suggest that benthic species exhibit the same sensitivity to chemical pollutants as water column species that were tested to derive water quality criteria (U.S. EPA, 2003b, 2005b).

Pore water was collected at a total of 13 stations at the Shipyard Sediment Site (Exponent 2001a). The measured pore water concentrations at these stations were compared to water quality criteria established in the California Toxics Rule (CTR) (U.S. EPA, 2000a) in 40 CFR 131.38. The CTR water quality criteria are applicable as water quality objectives[107] in California's inland surface waters, enclosed bays, and estuaries. Pore water chemical pollutant concentration excursions to levels above the CTR water quality criteria resulting from waste discharges represents a condition of condition of pollution[108] in waters of the State. This pollution condition would provide a basis for issuance of a cleanup and abatement order under Water Code section 13304. [109]

Comparisons were made to the saltwater criterion continuous concentration, which is the highest concentration of a chemical pollutant to which marine aquatic life can be exposed for an extended period of time without deleterious effects (Table 18-1)(Exponent, 2003). Of the 12 Shipyard Sediment Site stations sampled for pore water (SW02 was excluded by Exponent due to the presence of some suspended material remaining after centrifugation), 12 stations exceeded the copper CTR value, 6 stations exceeded the lead CTR value, and 12 stations exceeded the total PCBs CTR value (Table 18-2).

[107] "Water quality objectives" are defined in Water Code section 13050(h) as "the limits or levels water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

[108] "Pollution" is defined in Water Code section 13050 (1) as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following: (A) The waters for beneficial uses, (B) Facilities which serve these beneficial uses." Pollution" may include "contamination."

[109] Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides in relevant part that the Regional Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…"

Table 18-1. Water Quality Criteria Established in the California Toxics Rule

Compound	Saltwater Criterion Continuous Concentration (μg/L)
Arsenic	36
Cadmium	9.3
Chromium (VI)	50
Copper	3.1
Lead	8.1
Nickel	8.2
Selenium	71
Zinc	81
Total Polychlorinated Biphenyls[1]	0.03

[1] Sum of aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016.

Table 18-2. Comparison of Shipyard Pore Water Concentrations to CTR Water Quality Criteria

	Metals and PCBs (μg/L)								
Station	**As**	**Cd**	**Cr (VI)**	**Cu**	**Pb**	**Ni**	**Se**	**Zn**	**Total PCBs (Sum of Homologs)**
NA01	19	0.05	25	**14**	5.2	2.3	5.2	23	**0.068**
NA06	9.1	0.05	25	**33**	**12**	2.2	2.5	44	**0.20**
NA13	12	0.05	25	**14**	6.5	2.5	2.5	30	**0.056**
NA16	17	0.05	25	**22**	**9**	2.7	2.5	33	**0.094**
NA17	20	0.05	25	**23**	7	2.9	2.5	32	**0.084**
SW01	6.1	0.05	25	**17**	6.6	3	2.5	22	**0.50**
SW02 (outlier)	(11)	(4.2)	(25)	**(390)**	**(120)**	(37)	(6.1)	**(610)**	**(16)**
SW04	15	0.05	25	**55**	**20**	3.3	2.5	60	**0.60**
SW08	9.9	0.05	25	**33**	**12**	2	2.5	34	**0.52**
SW12	19	0.05	25	**17**	7.1	2.8	2.5	32	**0.080**
SW24	10	0.05	25	**25**	**9.8**	2.6	2.5	37	**0.67**
SW25	17	0.05	25	**28**	**13**	2.9	2.5	42	**0.18**
SW28	9	0.05	25	**19**	7.5	2.4	2.5	31	**0.29**

Note: Boxed and shaded values for shipyard locations exceed CTR water quality criteria.

Although the CTR criteria identified several chemical pollutants for which measured pore water concentrations are above maximum allowable CTR levels, the measured pore water concentrations may be biased high due to the possible presence of very fine suspended or colloidal material in the pore water samples that were not removed by centrifugation (Exponent, 2003). The pore water samples collected at the Shipyard Sediment Site were not filtered, in accordance with U.S. EPA guidance (U.S. EPA, 2001b), and were reported as total concentrations, whereas the CTR values are filtered and are reported as dissolved concentrations. However, the pore water results exceed the CTR criteria by multiples ranging from 1.1 to 20, excluding the results for SW02, as indicated in Table 18-3. Based on the magnitude of these exceedances, it is judged that the accumulation of pollutants in the Shipyard sediment has caused the pore water chemical pollutant concentrations to exceed the CTR water quality criteria. These exceedances represent a condition of pollution in waters of the State.

Table 18-3. Pore Water Concentrations as Multiples of CTR Water Quality Criteria

	Metals and PCBs (μg/L)								
Station	**As**	**Cd**	**Cr (VI)**	**Cu**	**Pb**	**Ni**	**Se**	**Zn**	**Total PCBs (sum of homologs)**
NA01	NA	NA	NA	**5**	NA	NA	NA	NA	**2**
NA06	NA	NA	NA	**11**	**1.5**	NA	NA	NA	**7**
NA13	NA	NA	NA	**5**	NA	NA	NA	NA	**2**
NA16	NA	NA	NA	**7**	**1.1**	NA	NA	NA	**3**
NA17	NA	NA	NA	**7**	NA	NA	NA	NA	**3**
SW01	NA	NA	NA	**5**	NA	NA	NA	NA	**17**
SW02 (outlier)	NA	NA	NA	**(126)**	**(15)**	NA	NA	**(8)**	**(533)**
SW04	NA	NA	NA	**18**	**2**	NA	NA	NA	**20**
SW08	NA	NA	NA	**11**	**1.5**	NA	NA	NA	**17**
SW12	NA	NA	NA	**5**		NA	NA	NA	**3**
SW24	NA	NA	NA	**8**	**1.2**	NA	NA	NA	**22**
SW25	NA	NA	NA	**9**	**2**	NA	NA	NA	**6**
SW28	NA	NA	NA	**6**	NA	NA	NA	NA	**10**

NA = Not applicable because the pore water concentration is below the CTR water quality criteria.

19. Finding 19: Fish Histopathology

The Regional Board evaluated fish histopathology data to determine the potential exposure and associated adverse effects ~~of~~ on fish ~~to~~ from chemical pollutants present within and adjacent to the Shipyard Sediment Site. A total of 253 spotted sand bass were examined for various histopathological lesions. These spotted sand bass were collected from four discrete assessment units at the Shipyard Sediment Site and at a reference area located across San Diego Bay near Reference Station 2240. The fish histopathology data indicates a total of 70 types of histopathological lesions were found in the spotted sand bass. Of the 70 types of lesions found, ~~only four~~ five lesions exhibited statistically significant elevations relative to reference conditions. The five lesions are abundant lipofuscin in liver, abundant hemosiderin in liver, cholangitis/biliary hyperplasia (CBH) in liver, nephritis in kidney, and shiny gill foci. ~~However, a fifth~~ A sixth lesion (i.e., ~~abundant hemosiderin in liver~~ foci of cellular alteration in livers) was considered important ~~by the pathologist and was nearly statistically significant for the purposes of this study~~ even though no statistical differences were found because the existence of these lesions indicates a harmful effect strongly linked to PAH exposure. ~~The five lesions and their severity with respect to reference conditions are summarized below.~~

Summary of Microscopic and Macroscopic Lesions Significantly Elevated Relative to Reference Conditions

		Prevalence of Lesions (percent)				
		NASSCO		BAE Systems (formerly Southwest Marine)		Reference Area
Lesion	Severity Scores	Inside	Outside	Inside	Outside	
Microscopic						
Liver						
Abundant Lipofuscin	0 – None	**74**	92	**75**	88	96
	1 – Mild	**12**	6	**6**	12	4
	2 – Moderate	**2**	2	**8**	0	0
	3 – Severe	**12**	0	**12**	0	0
Abundant Hemosiderin	0 – None	98	**78**	98	80	94
	1 – Mild	2	**22**	2	20	6
	2 – Moderate	0	**0**	0	0	0
	3 – Severe	0	**0**	0	0	0
Cholangitis /Biliary Hyperplasia	0 – None	**66**	76	80	80	88
	1 – Mild	**28**	24	14	20	12
	2 – Moderate	**6**	0	6	0	0
	3 – Severe	**0**	0	0	0	0
Foci of Cellular Alteration						
Eosinophilic Foci	NA	8	4	0	6	4
Basophilic Foci	NA	10	10	4	8	13
Clear Cell Foci	NA	10	2	6	4	2
Kidney						
Nephritis	0 – None	**48**	66	76	66	75
	1 – Mild	**48**	32	22	32	25
	2 – Moderate	**4**	2	0	2	0
	3 – Severe	**0**	0	2	0	0
Macroscopic						
Gill						
Shiny Gill Foci	0 – None	12	10	**0**	0	10
	1 – Mild	62	81	**0**	70	69
	2 – Moderate	24	8	**100**	28	20
	3 – Severe	2	0	**0**	2	2

Note: Boxed and shaded values indicate results significantly different relative to reference values.

Of the five six lesions identified as significantly elevated with respect to reference conditions, none two, CBH and foci of cellular alteration, has have been identified in other scientific field studies as being associated with sediment pollutant contaminant exposure. Scientific literature describing lesions that are potential biomarkers of environmental stressors in fish does not attribute causation of liposuscin lipofuscin, hemosiderin, cholangitis/biliary hyperplasia, nephritis, and shiny gill foci to pollution-related factors. It is plausible that the five lesions could have been caused by naturally occurring environmental factors such as infectious parasites. Based on these considerations the fish histopathology data does not indicate that the fish lesions observed in the data set can be conclusively attributed to contaminant exposure at the Shipyard Sediment Site.

19.1 Fish Histopathology Analyses

The Phase 1 sediment chemistry and bioaccumulation data indicated the potential for aquatic life impacts from elevated levels of contaminants in the sediment at the Shipyard Sediment Site. The sediment chemistry exceeded published threshold values for polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) therefore it was deemed necessary to assess the impacts on aquatic life from the contaminated sediment at the Shipyard Sediment Site through fish histopathology[110] analyses.

By letter dated July 16, 2002, the Regional Board directed NASSCO and BAE Systems (formerly Southwest Marine), pursuant to WC 13267, to investigate the potential for contaminant bioaccumulation in fish and the associated risks to fish health from the Shipyard Sediment Site and adjacent areas and to document the results in a technical report. The rationale and general guidelines for the fish histopathology investigation are provided in the July 16, 2002 letter (RWQCB, 2002a). The Regional Board consulted with the Natural Resource Trust Agencies (NRTAs)(U.S. FWS, DFG, NOAA, and OEHHA) to determine the study guidelines. The study was conducted in accordance with their recommendations.

PAHs and PCBs were of concern because the sediment concentrations indicated levels that exceeded published literature values and were potentially harmful to marine/estuarine fish within the Shipyard Investigation Site. PAH concentrations exceed a suggested sediment quality threshold of 1,000 ppb for PAHs at every NASSCO and BAE Systems sample station except for the reference stations (Johnson, 2000). Furthermore, studies on chinook salmon (*Oncorhynchus tshawytscha*) resulted in a PCB threshold value of 300 ppb (for total organic carbon (TOC) at 2 percent dry weight) (Meador, 2000). Of the 43 sample locations analyzed for PCBs at NASSCO and BAE Systems, the average TOC was 2.13 percent and 38 sample locations exceeded the suggested PCB threshold.

[110] Histopathology is the study of microscopic changes in tissue caused by disease.

PAHs are of particular interest because it is a common sediment contaminant found in coastal urban and industrial waterbodies and are found throughout the Shipyard Sediment Site. PAHs generally do not bioaccumulate in fish tissue like chlorinated hydrocarbons therefore exposure to PAHs cannot be assessed using traditional tissue analysis. PAH compounds are readily metabolized by the liver and secreted in the bile. While metabolism of these compounds serves as a way of breaking down and then excreting the PAH breakdown products, or metabolites, the metabolites have been shown to be carcinogenic, mutagenic, and cytotoxic (Johnson, 2000). Most fish histopathological studies focus on the liver because contaminants tend to concentrate in this organ; however, fish kidneys, gonads, and gills were also examined in the Shipyard Sediment Site.

19.2 Fish Histopathology Results

The findings and conclusions of the fish histopathology investigation are summarized below and are contained in a report prepared by NASSCO's and BAE System's consultant, Exponent, entitled "NASSCO and Southwest Marine Detailed Sediment Investigation, Volume 1, October 2003. Some additional information concerning other lesions is provided in this section of the Technical Report.

A total of 70 types of histopathological lesions were found in the spotted sand bass collected from four discrete assessment units at NASSCO and BAE Systems and within a reference area located across the bay from the shipyard sites. The four assessment units are as follows:

- Inside NASSCO – the area inside the NASSCO leasehold;
- Outside NASSCO – the area between the NASSCO leasehold and the shipping channel;
- Inside BAE Systems – the area inside the BAE Systems leasehold; and
- Outside BAE Systems – the area between the BAE Systems leasehold and the shipping channel.

Of the 70 types of lesions, five exhibited significant ($p \leq 0.05$) elevations at one or more shipyard locations relative to reference conditions. A sixth lesion (i.e., foci of cellular alteration in liver) was considered important even though no statistical differences were found because the existence of these lesions at any location indicates a harmful effect strongly linked to PAH. The six significant lesions included the following:

- Liver – Abundant lipofuscin – greater inside NASSCO and BAE Systems shipyards than in the reference area;
- Liver – Abundant hemosiderin – greater outside the NASSCO shipyard than in the reference area;
- Liver – Foci of cellular alteration – No significant differences from reference;

- Liver – Cholangitis/biliary hyperplasia (CBH) – greater inside the NASSCO shipyard than in the reference area;
- Kidney – Nephritis – greater outside the NASSCO shipyard than in the reference area; and
- Gill – Shiny gill foci – greater inside the BAE Systems shipyard than in the reference area.

The documented contaminate-related lesions are shown in Table 19-1. The severity of CBH lesions elevated above reference conditions were considered none to mild in most individual fish, with a few individual fish that had a lesion score of moderate. The presence foci of cellular alteration (eosinophilic foci, basophilic foci, and clear cell foci) were found not to be statistically elevated above reference but the presence of these lesions indicate exposure effects are occurring from PAHs.

Table 19-1. Summary of Prevalence of Contaminant-Related Lesions

		Prevalence of Lesions (Percent)				
		NASSCO		**BAE Systems**		**Reference Area**
Lesion	**Severity Scores**	**Inside**	**Outside**	**Inside**	**Outside**	
Microscopic						
Liver						
Cholangitis /Biliary Hyperplasia	0 – None	**66**	76	80	80	88
	1 – Mild	**28**	24	14	20	12
	2 – Moderate	**6**	0	6	0	0
	3 – Severe	**0**	0	0	0	0
Foci of Cellular Alteration						
Eosinophilic Foci	NA	8	4	0	6	4
Basophilic Foci	NA	10	10	4	8	13
Clear Cell Foci	NA	10	2	6	4	2

Note: Boxed and shaded values for shipyard locations are significantly greater relative to reference values.

As shown in Table 19-2, the severity of the four other lesions elevated above reference conditions were considered none to mild in most individual fish, while relatively few individual fish had lesions that were considered moderate (with the exception of shiny gill foci inside BAE Systems and severe. Moderate levels were observed in three of the lesions exceeding reference conditions with the most notable being shiny gill foci. Inside BAE Systems, all 51 fish had shiny gill foci lesion scores of 2 (moderate). Severe levels were observed in only one lesion elevated above reference conditions. Inside NASSCO and BAE Systems, 12 of the 101 fish collected had a lipofuscin lesion score of 3 (severe).

Table 19-2. Summary of Other Microscopic and Macroscopic Lesions Significantly Elevated Relative to Reference Conditions

		Prevalence of Lesions (Percent)				
		NASSCO		BAE Systems		Reference Area
Lesion	**Severity Scores**	**Inside**	**Outside**	**Inside**	**Outside**	
Microscopic						
Liver						
Abundant Lipofuscin	0 – None	**74**	92	**75**	88	96
	1 – Mild	**12**	6	**6**	12	4
	2 – Moderate	**2**	2	**8**	0	0
	3 – Severe	**12**	0	**12**	0	0
Abundant Hemosiderin	0 – None	98	**78**	98	80	94
	1 – Mild	2	**22**	2	20	6
	2 – Moderate	0	**0**	0	0	0
	3 – Severe	0	**0**	0	0	0
Kidney						
Nephritis	0 – Severe	**48**	66	76	66	75
	1 – Mild	**48**	32	22	32	25
	2 – Moderate	**4**	2	0	2	0
	3 – Severe	**0**	0	2	0	0
Macroscopic						
Gill						
Shiny Gill Foci	0 – None	12	10	**0**	0	10
	1 – Mild	62	81	**0**	70	69
	2 – Moderate	24	8	**100**	28	20
	3 – Severe	2	0	**0**	2	2

Note: Boxed and shaded values for shipyard locations are significantly greater relative to reference values.

19.3 Fish Histopathology Evaluation

A total of 253 spotted sand bass were collected using nets and by hook and line in five locations within San Diego Bay:

- Inside the NASSCO leasehold (50 fish);
- Immediately outside of the NASSCO leasehold (50 fish);
- Inside the BAE Systems leasehold (51 fish);
- Immediately outside of the BAE Systems leasehold (50 fish); and
- Within a reference area near Station 2240 located across the bay from NASSCO and BAE Systems (52 fish).

Field and laboratory methods used in the fish health assessment are presented in the Shipyard Report (Exponent, 2003) and Dr. Gary Marty's fish histopathology report (Marty, 2003).

Similar to the other lines of evidence, a key step in the fish histopathology evaluation is to determine whether the site conditions pose a greater risk than reference conditions. For the fish histopathology line of evidence, the lesions found in the spotted sand bass at the Shipyard Sediment Site were statistically compared to the presence (or absence) of lesions identified in spotted sand bass at the reference area. As specified by the Regional Board (RWQCB, 2002a), the reference area used for the fish histopathology evaluation is located near Station 2240 located across the bay from the shipyards. This reference area was selected because of its similar physical characteristics to the shipyard sites (grain size and water depth) and because of its relatively low PCB and PAH sediment concentrations. The statistical procedure used to compare site lesions to reference conditions consisted of nonparametric ANOVA, based upon the severity score for each lesion in each fish (i.e., scores of 0, 1, 2, and 3) (Exponent, 2003). When the ANOVA results were significant, two-tailed *a posteriori* comparisons were made between the results for each shipyard location and the results for the reference area.

The fish histopathology line of evidence was assessed by identifying lesions in each fish and then comparing the lesions to reference conditions in San Diego Bay. Identification of lesions and comparisons to reference conditions address absolute risk and site-specific relative risk, respectively. To determine whether lesion prevalence and severity were greater than the reference population and were potentially related to chemical exposure, the lesions were crosschecked against a list of toxicopathic lesions likely associated with contaminant exposure (Exponent, 2004; Klimas, 2004).

While it is difficult to establish a clear linkage between lesions in field-collected fish and contaminant exposure, studies have established lesions associated with contaminated sediment exposure (Johnson, 2000; Myers et al., 1994; Myers et al., 1998). Specifically, Exponent (2004) and NOAA (Klimas, 2004) identified lesions in field-collected fish that were contaminant-related. The lesions identified by Exponent are listed in the Table 19-3. Of the six types of lesions specifically mentioned in this section two are listed in Table 19-3: CBH (referred to in Table 19-3 as hepatocellular/biliary epithelial cell regeneration and hyperplasia) and FCA.

Table 19-3. Lesions Associated with Sediment Contaminant Exposure

Organ	Lesion
Liver	Loss of glycogen/increased basophilia
Liver	Hepatocellular coagulative necrosis, hypertrophy, hydropic degeneration, hepatocellular hyalinization
Liver	**Hepatocellular/biliary epithelial cell regeneration and hyperplasia; oval cell proliferation and cholangio-fibrosis**
Liver	Hepatocellular nuclear pleomorphism, megalocytosis
Liver	Hydropic vacuolation of biliary epithelial cells/hepatocytes
Liver	**Foci of cellular alteration (FCA) or altered hepatocellular foci (AHF), includes clear cell, vacuolated, eosinophilic, and basophilic foci**
Liver	Enzyme-altered foci
Liver	Hepathocellular adenoma and carcinoma; cholangioma, cholangiocarcinoma; mixed hepatobiliary carcinoma
Kidney	Tubular epithelial degeneration, necrosis, vacuolation, hyalinization, and exfoliation
Kidney	Glomerular lesions such as mesangiolysis and mesangiosclerosis
Ovary	Atresia of oocytes
Ovary	Intersex condition
Ovary	Atrophy, inhibited development
Ovary	Alteration in maturation
Testis	Germinal epithelial degeneration, necrosis, atrophy
Testis	Intersex condition

(Exponent, 2004)

Based on these considerations the fish histopathology data does not conclusively indicate that the fish lesions observed in the data set can be attributed to contaminant exposure at the Shipyard Sediment Site.

20. Finding 20: Fish Bile

The Regional Board evaluated fish bile sampling results to determine the potential exposure of fish to polynuclear aromatic hydrocarbon (PAH) compounds within and adjacent to the Shipyard Sediment Site. The bile samples were analyzed for fluorescent aromatic compounds (FACs) and total proteins. Three groups of FACs were measured that correspond to metabolites (PAH breakdown products) from naphthalene, phenanthrene, and benzo[a]pyrene. Metabolites were detected in bile of spotted sand bass captured inside and outside of the Shipyard Sediment Site and within a reference area located across the bay from the shipyard sites near Reference Station 2240. ~~The bile breakdown products include naphthalene, phenanthrene, and benzo[a]pyrene. Of the three breakdown products,~~

Metabolites of two contaminants exhibited elevated levels ~~statistically significant elevations~~ relative to reference conditions in spotted sand bass collected immediately outside of the Shipyard Sediment Site when their mean concentrations were compared against reference data. No ~~bile breakdown products~~ metabolites were significantly elevated relative to reference conditions in spotted sand bass collected inside of the Shipyard Sediment Sites. ~~These results indicate that fish at the Shipyard Sediment Site are no more greatly exposed to PAH compounds than fish at the reference area in San Diego Bay.~~

The upper prediction limit (UPL) at the 95 percent confidence interval was also calculated for the metabolites of the reference area fish and compared to replicate fish bile samples from the four areas of the Shipyard Sediment Site (i.e., inside and outside of both NASSCO and BAE Systems leaseholds). The inside and outside areas of NASSCO had samples that exceeded the UPL. Inside NASSCO accounted for six of the 19 UPL exceedances. Two fish bile samples from inside NASSCO exceeded the UPL for naphthalene, phenanthrene, and benzo[a]pyrene metabolites. From Outside NASSCO, 12 of the 13 UPL exceedances came from phenanthrene and benzo[a]pyrene metabolite samples.

For BAE Systems, all exceedances came from outside BAE Systems of which nine of 11 exceedances were for the benzo [a] pyrene metabolite samples. The remaining two exceedances were for the phenanthrene metabolite samples. No exceedances were found from inside BAE Systems; however, the PAH sediment chemistry data from inside BAE Systems showed the highest levels of sediment contamination.

The inconsistent relationship between the levels of FACs in fish and PAH contaminated sediment indicates that this data is inconclusive and the FAC concentrations observed in the fish cannot be exclusively attributed to contaminant exposure at the Shipyard Sediment Site. The variable nature of the sediment contamination found in bays and the mobility of the fish are confounding factors when attempting to correlate fish sampling results with sediment contamination.

Summary of Bile PAH Breakdown Products Significantly Elevated Relative to Reference Conditions

		NASSCO		BAE Systems	
	Reference Area	**Inside**	**Outside**	**Inside**	**Outside**
Naphthalene Metabolites (µg/mg protein)					
Mean	79	74.5	84.2	68.9	74
Standard Deviation	27.4	45.7	24.8	11.2	25.5
Minimum	58	26	64	55	49
Maximum	150	160	150	96	130
95% Upper Confidence Limit	131.7				
Phenanthrene Metabolites (µg/mg protein)					
Mean[1]	12.8	13.6	**26.7**	13.9	18.9
Standard Deviation	4.7	7.4	7.8	1.9	3.1
Minimum	7.1	5.7	20	11	14
Maximum	25	28	46	18	25
95% Upper Confidence Limit	21.9				
Benzo[a]pyrene Metabolites (µg/mg protein)					
Mean[1]	2.1	2.9	**5.3**	1.7	**6.0**
Standard Deviation	1.2	1.6	2.1	0.9	1.6
Minimum	0.7	0.5	2.7	0.7	2.8
Maximum	4.6	6	9.8	3.7	8.5
95% Upper Confidence Limit[1]	4.5				

Note: Boxed and shaded values for shipyard locations are significantly greater relative to reference values.

20.1 Fish Bile

To evaluate the potential aquatic life impacts from polynuclear aromatic hydrocarbons (PAHs) in the sediment at the Shipyard Investigation Site, fish bile from fish collected within and adjacent to the NASSCO and BAE Systems (formerly Southwest Marine) leaseholds was evaluated as one indicator of exposure of fish to PAHs. Unlike some metals and chlorinated hydrocarbons, PAHs are readily metabolized by fish and do not bioaccumulate in their tissue. Metabolism of PAHs occurs in the livers of fish and the process produces polar organic compounds that can be found and measured in the bile. These breakdown products or metabolites can be analyzed and can serve as an indication of the fish's recent exposure to PAHs.

20.2 Fish Bile Sampling and Analysis

A total of 253 spotted sand bass were collected using nets and by hook and line in five locations within San Diego Bay. The same fish were used in Finding 19: Fish Histopathology. These five areas are as follows:

- Inside the NASSCO leasehold (50 fish);
- Immediately outside of the NASSCO leasehold (50 fish);
- Inside the BAE Systems leasehold (51 fish);
- Immediately outside of the BAE Systems leasehold (50 fish); and
- A reference area near Station 2240 located across the bay from NASSCO and BAE Systems (52 fish).

As specified by the Regional Board (RWQCB, 2002a), the reference area used for the fish bile evaluation is located near Station 2240 located across the bay from the Shipyard Sediment Site. This reference area was selected because of its similar physical characteristics to the Shipyard Sediment Site (grain size and water depth) and because of its relatively low polychlorinated biphenyl (PCB) and PAH sediment concentrations.

Bile samples were composited to produce up to 10 samples from each of the five sampling locations. The bile samples were analyzed for fluorescent aromatic compounds (FACs) and total proteins. Three groups of FACs were measured, corresponding to the products from the metabolization of naphthalene, phenanthrene, and benzo[a]pyrene. Total protein was measured to allow the concentrations of PAH metabolites to be adjusted for differences in the nutritional state of the fish.

PAH metabolites were detected in bile of spotted sand bass captured inside and outside of the NASSCO and BAE Systems leaseholds, and within a reference area located across the bay from the Shipyard Sediment Site (Table 20-1).

20.2.1 Comparison of the Mean Concentrations in Fish Bile at the Shipyard Sediment Site with Reference Conditions

The mean metabolite concentrations from the reference area and the four areas of the Shipyard Sediment Site were calculated and compared to identify statistical differences. Table 20-1 presents the summary statistics of Shipyard Sediment Site and Reference area samples. Two of the three contaminant-related metabolite products exhibited statistically significant differences in the sand bass collected in the areas immediately outside of the NASSCO and BAE Systems leaseholds when their mean concentrations were compared against reference fish. No bile metabolites were significantly elevated relative to reference conditions for the spotted sand bass collected inside of either shipyard leasehold. The contaminants with significantly elevated metabolite levels include the following:

- Naphthalene – Concentrations in fish bile were greater outside NASSCO leasehold than in the reference area; and
- Benzo[a]pyrene – Concentrations in fish bile were greater outside NASSCO and BAE Systems leaseholds than in the reference area.

Table 20-1. Summary of PAH Metabolites Measured in Fish Bile

		NASSCO		BAE Systems	
	Reference Area	Inside	Outside	Inside	Outside
Naphthalene Metabolites (μg/mg protein)					
Mean	79	74.5	84.2	68.9	74
Standard Deviation	27.4	45.7	24.8	11.2	25.5
Minimum	58	26	64	55	49
Maximum	150	160	150	96	130
95% Upper Confidence Limit	131.7				
Phenanthrene Metabolites (μg/mg protein)					
Mean[1]	12.8	13.6	**26.7**	13.9	18.9
Standard Deviation	4.7	7.4	7.8	1.9	3.1
Minimum	7.1	5.7	20	11	14
Maximum	25	28	46	18	25
95% Upper Confidence Limit	21.9				
Benzo[a]pyrene Metabolites (μg/mg protein)					
Mean[1]	2.1	2.9	**5.3**	1.7	**6.0**
Standard Deviation	1.2	1.6	2.1	0.9	1.6
Minimum	0.7	0.5	2.7	0.7	2.8
Maximum	4.6	6	9.8	3.7	8.5
95% Upper Confidence Limit[1]	4.5				

[1] Some or all of the data was qualified as estimates. See Table E-4 from the Shipyard Report (Exponent, 2003).

Note: Boxed and shaded values for shipyard locations are significantly greater relative to reference values.

20.2.2 Comparison of the Upper Prediction Limit to Replicate Data

The upper prediction limit (UPL) at the 95 percent confidence interval was also calculated for the reference area fish. The field replicate data from the four Shipyard Sediment Site areas was compared against the 95 percent UPL for the reference fish bile samples. Table 20-2, below, provides a summary of the fish bile samples from the Shipyard Sediment Site that exceeded the 95 percent UPL. A summary of the descriptive statistics and ANOVA results is provided in Appendix for Section 20 of this Technical Report. The replicate data can be found in Appendix E of the Shipyard Report (Exponent, 2003).

Table 20-2. Summary of Fish Bile Samples that Exceeded the 95% UPL

	NASSCO		BAE Systems	
	Inside	**Outside**	**Inside**	**Outside**
Naphthalene Metabolites	2	1	0	0
Phenanthrene Metabolites[1]	2	7	0	2
Benzo [a] pyrene Metabolites[1]	2	5	0	9
Sample Size	**10**	**10**	**10**	**10**

[1] Some or all of the data was qualified as estimates. See Table E-4 from the Shipyard Report (Exponent, 2003).

Both the inside and outside areas of the NASSCO leasehold had samples that exceeded the 95 percent UPL. The outside area of NASSCO accounted for 13 of the 19 UPL exceedances, which were almost exclusively from phenanthrene and benzo [a] pyrene metabolite samples. The outside area of BAE Systems accounted for all of their UPL exceedances with 9 of the 11 exceedances from benzo [a] pyrene. No exceedances were found from the inside area of BAE Systems for any of the three PAH metabolites.

20.3 Discussion

The fish bile line of evidence was assessed by determining the presence of PAH metabolites and then comparing the PAH bile concentrations to reference conditions in San Diego Bay. The objective was to determine if the fish from the Shipyard Sediment Site were exposed to PAHs and, if so, was this exposure greater than those indicated in the fish from the reference area. Identification of PAH metabolites and comparisons to reference conditions address absolute risk and site-specific relative risk, respectively.

The PAH sediment chemistry data from inside BAE Systems showed the highest levels of sediment contamination but the metabolite levels from fish collected from inside BAE showed no significant differences from reference. Therefore, the FAC concentrations observed in the fish collected cannot be exclusively attributed to contaminant exposure at the Shipyard Sediment Site.

These results are similar to other studies conducted in Southern California, which have found an inconsistent relationship between FACs in fish and sediment contaminated with PAHs (Brown and Steinert, 2004). The variable nature of the sediment contamination found in bays along with mobility of the fish species selected are confounding factors when attempting to correlate fish sampling results with sediment contamination.

21. Finding 21: Indicator Sediment Chemicals

The Regional Board evaluated the relationships between sediment chemical~~s~~ pollutants and biological responses to identify indicator chemical~~s~~ pollutants ~~(i.e., chemicals of potential concern)~~ that may be impacting aquatic life and would therefore be candidates for assignment of cleanup levels or remediation goals. A two-step process was conducted. The first step in the selection of indicator chemicals was to identify chemicals representative of the major classes of sediment pollutants: metals, butyltins, PCBs and PCTs, PAHs, and petroleum hydrocarbons. The second step was the evaluation of relationships between these chemicals and biological responses. Results of the three toxicity tests, benthic community assessment, and bioaccumulation testing conducted in Phase 1 of the Shipyard study were all used to evaluate the potential of such relationships. Chemical~~s~~ pollutants were selected as indicator chemicals if they had any statistically significant relationship with amphipod mortality, echinoderm fertilization, bivalve development, total benthic macroinvertebrate abundance, total benthic macroinvertebrate richness, or tissue chemical concentrations in *Macoma nasuta*. Chemical~~s~~ pollutants selected as indicator chemicals include arsenic, copper, lead, mercury, zinc, TBT, total PCB homologs, diesel range organics (DRO), and residual range organics (RRO).

21.1 Indicator Sediment Chemical Pollutants

A two-step approach was used to identify indicator chemical pollutants that may be impacting aquatic life beneficial uses as identified in Finding 16 – Sediment Quality Triad Results (Exponent, 2003). The first step consisted of selecting chemical pollutants representative of the major classes of sediment pollutants at the Shipyard Sediment Site and the second step evaluated those chemicals with observed relationships to biological responses.

The major classes of sediment chemical pollutants identified in Step 1 were metals, butyltins, polychlorinated biphenyls (PCB) and polychlorinated terphenyls (PCT), PAH, and petroleum hydrocarbons. Specific chemical pollutants were selected to represent each of these classes:

- **Metals –** All metals except for selenium were selected as indicator chemical pollutants. Selenium was excluded due to it relatively low detection frequency and because the detected values were equal to the quantitation limit;
- **Butyltins –** Tributyltin (TBT) was selected as an indicator chemical pollutant because it is commonly used in marine antifouling paints;

- **PCBs and PCTs –** The sum of PCB homologs was used because it more accurately represents total PCBs as opposed to the sum of congeners (not all congeners were measured) and the sum of Aroclors. The sum of PCT Aroclors measured was used to represent total PCTs;
- **PAH –** The sum of all high-molecular-weight PAHs (HPAH) was used to represent PAH compounds. The sum of low-molecular-weight PAHs (LPAH) and the sum of all PAH compounds were not used because most LPAH compounds were undetected; and
- **Petroleum Hydrocarbons -** Diesel-range organics (DRO) and residual-range organics (RRO) were used to represent petroleum hydrocarbons. Gasoline-range organics (GRO) was not used because it was undetected.

In Step 2, the chemical pollutants identified above were selected as indicator chemical pollutants if they had any statistically significant relationship with biological effects. Amphipod mortality, echinoderm fertilization, bivalve development, total benthic macroinvertebrate abundance, total benthic macroinvertebrate richness, and tissue chemical concentrations in *Macoma nasuta* were used to evaluate the potential of such relationships. Based on the chemical and biological response comparisons (Table 21-1), the chemicals selected as indicator chemicals included arsenic, copper, lead, mercury, zinc, TBT, total PCB homologs, DRO, and RRO (Exponent, 2003). All of these indicator chemicals, except for DRO and RRO, are considered to have possible impacts on aquatic-dependent wildlife or human health because of their statistical relationship with the *Macoma* tissue bioaccumulation results. DRO and RRO are considered to have possible impacts on aquatic life because of their statistical relationship with the benthic community results.

Table 21-1. Relationships of Sediment Chemical Pollutants to Biological Effects

Chemical	Statistical Relationship to:						Selected as Indicator Chemical?
	Amphipod Toxicity	Echinoderm Toxicity	Bivalve Toxicity	Benthic Macroinvertebrate Total Abundance	Benthic Macroinvertebrate Total Richness	Macoma Tissue Bioaccumulation	
Arsenic	No	No	No	No	No	Yes [1]	Yes
Cadmium	No	No	No	No	No	No	No
Chromium	No	No	No	No	No	No	No
Copper	No	No	No	No	No	Yes	Yes
Lead	No	No	No	No	No	Yes	Yes
Mercury	No	No	No	No	No	Yes	Yes
Nickel	No	No	No	No	No	No	No
Silver	No	No	No	No	No	No	No
Zinc	No	No	No	No	No	Yes	Yes
TBT	No	No	No	No	No	Yes	Yes
HPAH	No	No	No	No	No	Yes	Yes
Total PCB homologs	No	No	No	No	No	Yes	Yes
PCTs	No	No	No	No	No	No	No
DRO	No	No	No	No	Yes	-- [2]	Yes
RRO	No	No	No	Yes	Yes	-- [2]	Yes

[1] The relationship is controlled by a single point.
[2] Not evaluated.

22. Finding 22: Aquatic-Dependent Wildlife Impairment

Aquatic-dependent wildlife beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site~~s~~. Aquatic-dependent wildlife beneficial uses include: Wildlife Habitat (WILD), Preservation of Biological Habitats of Special Significance (BIOL), and Rare, Threatened, or Endangered Species (RARE). This finding is based on the considerations described below in the *Impairment of Aquatic-Dependent Wildlife Beneficial Uses* section of the Cleanup and Abatement Order.

22.1 Aquatic-Dependent Wildlife Beneficial Uses

There are three beneficial uses designated in the Basin Plan for San Diego Bay (RWQCB, 1994), which must be fully protected in order to provide for the protection of aquatic-dependent wildlife:

- **Wildlife Habitat (WILD) –** Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources;
- **Preservation of Biological Habitats of Special Significance (BIOL) –** Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection; and
- **Rare, Threatened, or Endangered Species (RARE) –** Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

The concentrations of the pollutants present in the marine sediment within and adjacent to the Shipyard Sediment Site causes or threatens to cause a condition of pollution or contamination that adversely impacts these three beneficial uses and thereby constitutes a threat to the aquatic-dependent wildlife. Information supporting this conclusion is contained in Sections 23 through 25 of this report.

23. Finding 23: Risk Assessment Approach for Aquatic-Dependent Wildlife

The Regional Board evaluated potential risks to aquatic-dependent wildlife from chemical pollutants present in the sediments at the Shipyard Sediment Site based on a two-tier approach. ~~This approach used an area use factor (AUF) of 1 and other conservative assumptions.~~ The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using the protocols specified by American Society of Testing Material (ASTM). The Tier II comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. ~~The key receptors of concern considered in both tiers include:~~

~~a. Aquatic-Dependent Birds - California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Surf scoter (*Melanitta perspicillata*), and Western grebe (*Aechmophorus occidentalis*);~~

~~b. Marine Mammals - California sea lion (*Zalophus californianus*);~~

~~c. Marine Reptiles - East Pacific green turtle (*Chelonia mydas agassizii*); and~~

~~d. Submerged Aquatic Plants - Eelgrass (*Zostera marina*)~~

23.1 Two-Tiered Risk Assessment Approach

A two-tiered approach was used to evaluate potential risks to aquatic-dependent wildlife from chemical pollutants present at the Shipyard Sediment Site. Tier I was a screening level risk assessment that uses conservative exposure and effects assumptions to support risk management decisions. Tier II was a comprehensive risk assessment (i.e., baseline risk assessment) that more accurately characterizes potential risk to receptors of concern primarily by replacing the conservative assumptions required by Tier I with site-specific exposure parameters.

The approach used in Tiers I and II was conducted in accordance with U.S. EPA's "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final)" (U.S. EPA, 1997a) and with California Department of Toxic Substances Control's "Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities" (DTSC, 1996). The approach consists of the following key elements:

- Selection of Receptors of Concern
- Exposure Characterization
- Effects Characterization
- Risk Characterization
- Risk Management
- Uncertainties Related to Risk Estimates

These elements are discussed in more detail in Section 24 – Tier I Screening Level Risk Assessment and Section 25 – Tier II Comprehensive Risk Assessment of this report.

24. Finding 24: Tier I Screening Level Risk Assessment for Aquatic-Dependent Wildlife

The Tier I risk assessment objectives were ~~objective was~~ to determine whether or not Shipyard Sediment Site conditions pose a potential unacceptable risk to aquatic-dependent wildlife receptors of concern and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment).~~[111]~~ The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Chemical pollutant concentrations measured in clam tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure to these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site. The chemical pollutants in *Macoma* tissue posing a potential risk include arsenic, copper, lead, zinc, benzo[a]pyrene, and total PCBs. ~~Potential risks were characterized by: (1) applying the hazard quotient (HQ) approach using *Macoma nasuta* tissue data from the bioaccumulation tests, and (2) comparing *Macoma nasuta* tissue concentrations from the shipyard sites to *Macoma nasuta* tissue concentrations from baseline conditions. Based on the Tier I results, the Regional Board identified six of nine Shipyard Sediment Site stations with *Macoma nasuta* tissue data as "likely" risks to the receptors of concern; thus requiring a Tier II risk assessment. The chemical pollutants of concern targeted for further study included arsenic, copper, lead, zinc, benzo[a]pyrene, and total PCBs.~~

~~Summary of Tier I Screening Level Risk Assessment Results~~

~~Station~~	~~Receptors "Likely" at Risk~~					~~Contaminants Posing "Likely" Risk to Receptors~~
	~~Brown Pelican~~	~~Least Tern~~	~~Sea Lion~~	~~Surf Scoter~~	~~Western Grebe~~	
~~NA06~~	~~X~~	~~X~~		~~X~~	~~X~~	~~Lead~~
~~SW04~~			~~X~~			~~Arsenic~~
	~~X~~	~~X~~		~~X~~	~~X~~	~~Copper, Lead~~
	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~Zinc~~
		~~X~~				~~Benzo[a]pyrene~~
~~SW08~~	~~X~~	~~X~~		~~X~~	~~X~~	~~Lead~~
		~~X~~				~~Zinc~~
		~~X~~				~~Benzo[a]pyrene, PCBs~~
~~SW13~~	~~X~~	~~X~~		~~X~~	~~X~~	~~Copper~~
		~~X~~				~~Zinc~~
	~~X~~	~~X~~				~~PCBs~~
~~SW21~~	~~X~~	~~X~~		~~X~~	~~X~~	~~Lead~~
		~~X~~				~~Zinc, Benzo[a]pyrene~~
	~~X~~	~~X~~				~~PCBs~~

~~[111] Potential risks were characterized by (1) applying the hazard quotient (HQ) approach using *Macoma nasuta* tissue data from the bioaccumulation tests, and (2) comparing *Macoma nasuta* tissue concentrations from the shipyard sites to *Macoma nasuta* tissue concentrations from baseline conditions.~~

~~SW28~~		~~X~~				~~Zinc, PCBs~~

~~**Note:** The East Pacific green turtle and eelgrass were not included in the analysis due to the lack of specific exposure parameters and toxicity reference values for these receptors of concern.~~

24.1 Tier I Results

For the Tier I screening level risk assessment, six aquatic-dependent wildlife species were identified as potential receptors that could be at risk due to exposure to chemicals in prey caught at the Shipyard Sediment Site. The six receptors include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus)*, Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Chemical concentrations measured in *Macoma nasuta* tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure for these receptors of concern.

Based on the Tier I results, as summarized in Table 24-1 below, the Regional Board determined that there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site and that a comprehensive, site specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The chemical pollutants in *Macoma* tissue posing a potential risk include arsenic, copper, lead, zinc, benzo[a]pyrene (BAP), and total polychlorinated biphenyls (PCBs). The Tier I risk calculations and results are provided in the Appendix for Section 24.

Table 24-1. Summary of Tier I Aquatic-Dependent Wildlife Risk Assessment Results

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing a Potential Risk [2]
NA06	Brown Pelican	Lead	Benzo[a]pyrene (BAP), total polychlorinated biphenyls (PCBs), tributyltin (TBT), arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Least Tern	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Western Grebe	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Green Turtle	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
NA11	Brown Pelican	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Least Tern	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Green Turtle	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing a Potential Risk [2]
NA12	Brown Pelican	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Least Tern	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Green Turtle	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
NA20	Brown Pelican	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Least Tern	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Green Turtle	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing a Potential Risk [2]
SW04	Brown Pelican	Copper, lead, zinc	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium
	Least Tern	Copper, lead, zinc, BAP	PCBs, TBT, arsenic, chromium, mercury, nickel, selenium
	Sea Lion	Arsenic, zinc	BAP, PCBs, TBT, chromium, copper, lead, mercury, nickel, selenium
	Surf Scoter	Copper, lead, zinc	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium
	Western Grebe	Copper, lead, zinc	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium
	Green Turtle	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
SW08	Brown Pelican	Copper, lead	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Least Tern	Copper, lead, zinc, BAP	PCBs, TBT, arsenic, chromium, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	Copper, lead	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Western Grebe	Copper, lead	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Green Turtle	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing a Potential Risk [2]
SW13	Brown Pelican	Copper, total PCBs	BAP, TBT, arsenic, chromium, lead, mercury, nickel, selenium, zinc
	Least Tern	Copper, zinc, total PCBs	BAP, TBT, arsenic, chromium, lead, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	Copper, lead	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Western Grebe	Copper	BAP, PCBs, TBT, arsenic, chromium, lead, mercury, nickel, selenium, zinc
	Green Turtle	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
SW21	Brown Pelican	Lead, total PCBs	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Least Tern	Lead, zinc, BAP, total PCBs	TBT, arsenic, chromium, copper, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Western Grebe	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Green Turtle	Lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing a Potential Risk [2]
SW28	Brown Pelican	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Least Tern	Zinc, total PCBs	BAP, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Green Turtle	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc

[1] A potential risk is defined if the hazard quotient (HQ) is greater than 1.0 AND greater than the reference 95% upper prediction limit Macoma tissue concentration.
[2] Not posing a potential risk is indicated if the HQ is less than 1.0 OR if the HQ is greater than 1.0 AND less than the reference 95% upper prediction limit Macoma tissue concentration.

24.2 Tier I Approach

The Regional Board conducted a Tier I screening level risk assessment to determine whether or not the current conditions at the Shipyard Sediment Site pose a potential unacceptable risk to aquatic-dependent wildlife receptors of concern and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). Potential risks were characterized by: (1) quantifying the risks at the site using the hazard quotient (HQ) approach, and (2) comparing clam tissue concentrations exposed to site sediment to clam tissue concentrations exposed to reference sediment.

The approach used in the Tier I screening level risk assessment was conducted in accordance with U.S. EPA's "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final" (U.S. EPA, 1997a), U.S. EPA's "Guidelines for Ecological Risk Assessment (EPA/630/R-95/002F)" (U.S. EPA, 1998b), and with California Department of Toxic Substances Control's "Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities" (DTSC, 1996). The approach consists of the following key elements:

- Selection of Receptors of Concern
- Exposure Characterization
- Effects Characterization
- Risk Characterization
- Risk Management
- Uncertainties Related to Risk Estimates

These key elements are discussed in more detail below.

24.2.1 Selection of Receptors of Concern

For Tier I, fish-eating marine birds and mammals, mollusk-eating birds, and sea grass-eating reptiles were identified as important groups of aquatic-dependent wildlife that may be at risk due to exposure to chemicals in prey species at the Shipyard Sediment Site (Exponent, 2002). Six species were identified as suitable representative receptors for assessing potential risk to these groups as reviewed and approved by U.S. Fish and Wildlife Service (U.S. FWS), California Department of Fish and Game (DFG), and National Oceanic and Atmospheric Administration (NOAA) (collectively known as the "Natural Resource Trustee Agencies"). The six species are shown in Table 24-2 below. These receptors were selected based on characteristics such as their presence at the site, feeding habits, known adverse effects from exposure to bioaccumulative chemical pollutants, the availability of ample life history information in the literature, and federal or state listings of species as threatened or endangered.

Table 24-2. Receptors Selected for the Tier II Risk Assessment

Receptor	Scientific Name	Representative of	Comments
California least tern	*Sterna antillarum brownie*	Marine birds that may feed on small fish	Federal and California listed endangered species
California brown pelican	*Pelecanus occidentalis californicus*	Marine birds that may feed on small- to medium-sized fish	Federal and California listed endangered species
Western grebe	*Aechmophorus occidentalis*	Diving marine birds that may feed on small fish	
Surf scoter	*Melanitta perspicillata*	Diving marine birds that may feed on mollusks	
California sea lion	*Zalophus californianus*	Marine mammals that may feed on medium-sized fish	
East Pacific green turtle	*Chelonia mydas agassizii*	Marine reptiles that may feed on sea grasses	Listed as threatened wherever found and listed as endangered in Florida and on the Pacific coast of Mexico

24.2.2 Exposure Characterization

The primary routes of exposure to chemical pollutants at the Shipyard Sediment Site are through the ingestion of prey items and the incidental ingestion of sediment during foraging (Exponent, 2003). Separate chemical pollutant exposure estimates were developed for each receptor at each of the Shipyard Sediment Site stations where bioaccumulation tests were conducted. For Tier I, bioaccumulation tests were conducted using sediment from four stations in the NASSCO leasehold (NA06, NA11, NA12, and NA20) and five stations in the BAE Systems leasehold (SW04, SW08, SW13, SW21, and SW28). These stations were positioned along an expected gradient of sediment concentrations of potentially bioaccumulative substances at each shipyard leasehold. The bioaccumulation tests involved the exposure of the clam *Macoma nasuta* to bay sediment at the Shipyard Sediment Site for 28 days using the protocols specified by ASTM (2001).

The tissue concentrations derived from these tests were used as the surrogate for prey tissue data, even though mollusks are not a major component of the diet for most of the receptors of concern selected for this risk analysis. Because *Macoma* actively ingests surface sediment (likely to be the most direct route of exposure to pollutants that accumulate in tissues), use of *Macoma* tissue data for all receptors of concern including those that exclusively feed on fish is considered a relatively conservative approach.

Exposure estimates for the six receptors were developed using the following general intake equation (DTSC, 1996):

$$\textbf{Daily Intake}_{\textbf{chemical}} = \textbf{(CM x CR x FI x AF) / BW}$$

where:

CM	=	concentration of the chemical in a given dietary component or inert medium (mg/kg)
CR	=	contact rate (i.e., ingestion rate) of dietary component or inert medium (kg/day)
FI	=	fraction of the daily intake of a given dietary component or inert medium derived from the site (unitless area-use factor)
AF	=	relative gastrointestinal absorption efficiency for the chemical in a given dietary component or inert medium (fraction)
BW	=	Body weight of receptor species (kg)

The intake equation was further expanded to account for the ingestion of prey items and the incidental ingestion of sediment:

$$\textbf{Daily Intake}_{\textbf{chemical}} = \textbf{[(CM x CR x FI x AF)}_{\textbf{prey}} + \textbf{(CM x CR x FI x AF)}_{\textbf{sediment}}\textbf{]/BW}$$

The assumptions used by the Regional Board in the expanded equation to estimate receptor exposure at each site stations are shown in Table 24-3 below and the exposure estimate calculations using these assumptions are provided in the Appendix for Section 24.

Table 24-3. Exposure Parameters for Tier I Screening Level Risk Assessment

Receptor	Prey Tissue Concentration (mg/kg dry wt)	Sediment Chemical Concentration (mg/kg dry wt)	Body Weight (kg)	Food Ingestion Rate (kg/day dry wt)	Sediment Ingestion Rate (kg/day dry wt)	Area Use Factor	Absorption Efficiency
California brown pelican	Maximum Detected Value	Maximum Detected Value	2.845[a]	0.23[b]	0.005	1	1
California least tern	Maximum Detected Value	Maximum Detected Value	0.036[c]	0.044[d]	0.0011	1	1
Western grebe	Maximum Detected Value	Maximum Detected Value	0.808[e]	0.046[d]	0.0031	1	1
Surf scoter	Maximum Detected Value	Maximum Detected Value	0.859[f]	0.048[d]	0.0028	1	1
California sea lion	Maximum Detected Value	Maximum Detected Value	45.0[g]	0.99[h]	0.0308	1	1
East Pacific green turtle	Maximum Detected Value	Maximum Detected Value	95[i]	0.31[j]	0.0186	1	1

[a] Mean female weight minus 1 standard deviation from Dunning (1993).
[b] Based on Nagy et al. (1999) equation for Pelecaniformes.
[c] Minimum adult body weight from Thompson et al. (1997).
[d] Based on U.S. EPA (1993a) equation for non-passerine birds.
[e] Minimum female body weight from Storer and Nuechterlein (1992).
[f] Minimum average female weight, as cited in Savard et al. (1998).
[g] Minimum female weight from Whitaker (1997).
[h] Based on Nagy et al. (1999) equation for Carnivora.
[i] Median adult weight from Cornelius (1986).
[j] Based on data in Bjorndal (1980).

24.2.3 Effects Characterization

Characterizing potential adverse effects to the receptors of concern requires a comparison of the receptor-specific exposure estimates to an appropriate toxicity reference value (TRV). As recommended by the Natural Resource Trustee Agencies, exposure estimates for the Tier I screening level risk assessment were compared to TRVs developed by the U.S. Navy/U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) (DTSC, 2000). The BTAG TRVs were developed jointly by the U.S. Navy, Navy consultants, and regulatory agencies, including the U.S. EPA, California Department of Toxic Substances Control – Human and Ecological Risk Division (DTSC), Regional Water Quality Control Board, NOAA, U.S. FWS, Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA), and DFG. The U.S. EPA, DTSC, and the other agencies endorse and recommend the use of the BTAG TRVs for ecological risk assessments conducted in California and in U.S. EPA Region IX.

The BTAG TRVs are presented as an upper and lower estimate of effects thresholds. The low-TRV is based on no-adverse-effects-levels (NOAELs) and represents a threshold below which no adverse effects are expected. The high-TRV is based on an approximate midpoint of the range of effects levels and represents a threshold above which adverse effects are likely to occur. The BTAG low and high TRVs for birds and mammals (site chemicals of concern only) are shown in Table 24-4 below. Because BTAG TRVs are not available for benzo[a]pyrene for birds and chromium for birds and mammals, the NOAELs and low-adverse-effects-levels (LOAELs) identified by Exponent (2003) were used (Table 24-5). It should be noted that suitable reptilian TRVs were not found in the literature (Exponent, 2003). Therefore, avian TRVs were used to estimate potential adverse effects to the East Pacific green turtle.

Table 24-4. U. S. Navy/U.S. EPA Region 9 BTAG Toxicity Reference Values for Birds and Mammals (Shipyard Chemicals of Concern Only)

	Birds		Mammals	
Chemical	**Low TRV (mg/kg-day)**	**High TRV (mg/kg-day)**	**Low TRV (mg/kg-day)**	**High TRV (mg/kg-day)**
Arsenic	5.5	22.0	0.32	4.7
Benzo[a]pyrene	NA	NA	1.31	32.8
Butyltins	0.73	45.9	0.25	15
Cadmium	0.08	10.4	0.06	2.64
Chromium	NA	NA	NA	NA
Copper	2.3	52.3	2.67	632
Lead	0.014	8.75	1.0	241
Mercury	0.039	0.18	0.027	0.27
	NA	NA	0.25	4.0
Nickel	1.38	56.3	0.133	31.6
PCBs	0.09	1.27	0.36	1.28
Selenium	0.23	0.93	0.05	1.21
Zinc	17.2	172	9.6	411

NA – not available

Table 24-5. NOAELs and LOAELs for Benzo[a]pyrene and Chromium Identified by Exponent

	Birds		Mammals	
Chemical	**NOAEL (mg/kg-day)**	**LOAEL (mg/kg-day)**	**NOAEL (mg/kg-day)**	**LOAEL (mg/kg-day)**
Benzo[a]pyrene	0.14	1.4	Not Used	Not Used
Chromium	0.86	4.3	3.3	69

(Exponent, 2003)

24.2.4 Risk Characterization

For the Tier I screening level risk assessment, the Regional Board characterized potential risks of adverse effects to the receptors of concern by quantifying the risks at each of the site stations. Risks were estimated by integrating the exposure and effects assessments in Section 24.2.2 and 24.2.3 above using the hazard quotient approach:

$$\mathbf{HQ_{low} = IR_{chemical} / TRV_{low}}$$

$$\mathbf{HQ_{high} = IR_{chemical} / TRV_{high}}$$

where:

HQ	=	Hazard quotient (unitless)
$IR_{chemical}$	=	total ingestion rate of the chemical (mg/kg body weight-day)
TRV	=	BTAG low or high toxicity reference value (mg/kg body weight-day)

An HQ value less than 1.0 indicates that the chemical is unlikely to cause adverse ecological effects to the receptor of concern. An HQ value greater than 1.0 indicates that the receptor's exposure to the chemical has exceeded the TRV, which could indicate that there is a potential that some fraction of the population may experience an adverse effect (Exponent, 2003). The HQ calculations and results for each receptor of concern at each assessment unit are provided in the Appendix for Section 24.

In addition to characterizing the risks at the Shipyard Sediment Site, the *Macoma* tissue concentrations at each site station were compared to the *Macoma* tissue concentrations derived from the reference station pool described in Section 15 of this Technical Report. The objective of this comparison was to determine whether or not the current Shipyard Sediment Site conditions pose a greater risk to the receptors of concern than the current reference conditions in San Diego Bay.

The 95% upper prediction limit (UPL) was calculated for the reference pool *Macoma* tissue concentrations. The 95% UPL allows a one-to-one comparison to be performed between a single Shipyard Sediment Site station (i.e., each of the nine bioaccumulation site stations) and a pool of "Reference Condition" stations (i.e., Reference Pool). Although multiple comparisons were made to the reference pool prediction limits, the Regional Board made a decision to not correct for multiple comparisons so that the site/reference *Macoma* tissue comparisons would remain conservative and more protective. The 95% UPL for the reference pool *Macoma* tissue concentrations are provided in Table 24-6 below and the comparison results are provided in the Appendix for Section 24.

Table 24-6. Reference Pool 95% Upper Prediction Limits for *Macoma nasuta* Tissue Concentrations

***Macoma* Tissue Chemicals**	**95% Upper Prediction Limits**
Metals	
Arsenic	22.8 mg/kg
Cadmium	0.39 mg/kg
Chromium	3.9 mg/kg
Copper	19.2 mg/kg
Lead	3.3 mg/kg
Mercury	0.15 mg/kg
Nickel	4.4 mg/kg
Selenium	4.9 mg/kg
Silver	0.57 mg/kg
Zinc	85.7 mg/kg
Organometallic Compounds	
Tributyltin	12 μg/kg
Organics	
Benzo[a]pyrene	132 μg/kg
Total Polychlorinated Biphenyls (PCB), as congeners	186 μg/kg
Total Polychlorinated Terphenyls (PCT)	All Reference Pool stations undetected

24.2.5 Risk Management

The Regional Board identified two risk management decisions for the Tier I screening level risk assessment: (1) Current Shipyard Sediment Site conditions pose acceptable risks and no further action is warranted, and (2) Current Shipyard Sediment Site conditions pose a potential unacceptable risk that requires additional evaluation with a Tier II baseline risk assessment. These two management decisions are based on the risk characterization results at each Shipyard Sediment Site station and the *Macoma* tissue site/reference comparison results. A flow diagram showing how each management decision is triggered is shown below and the results are presented in Table 24-1 above.

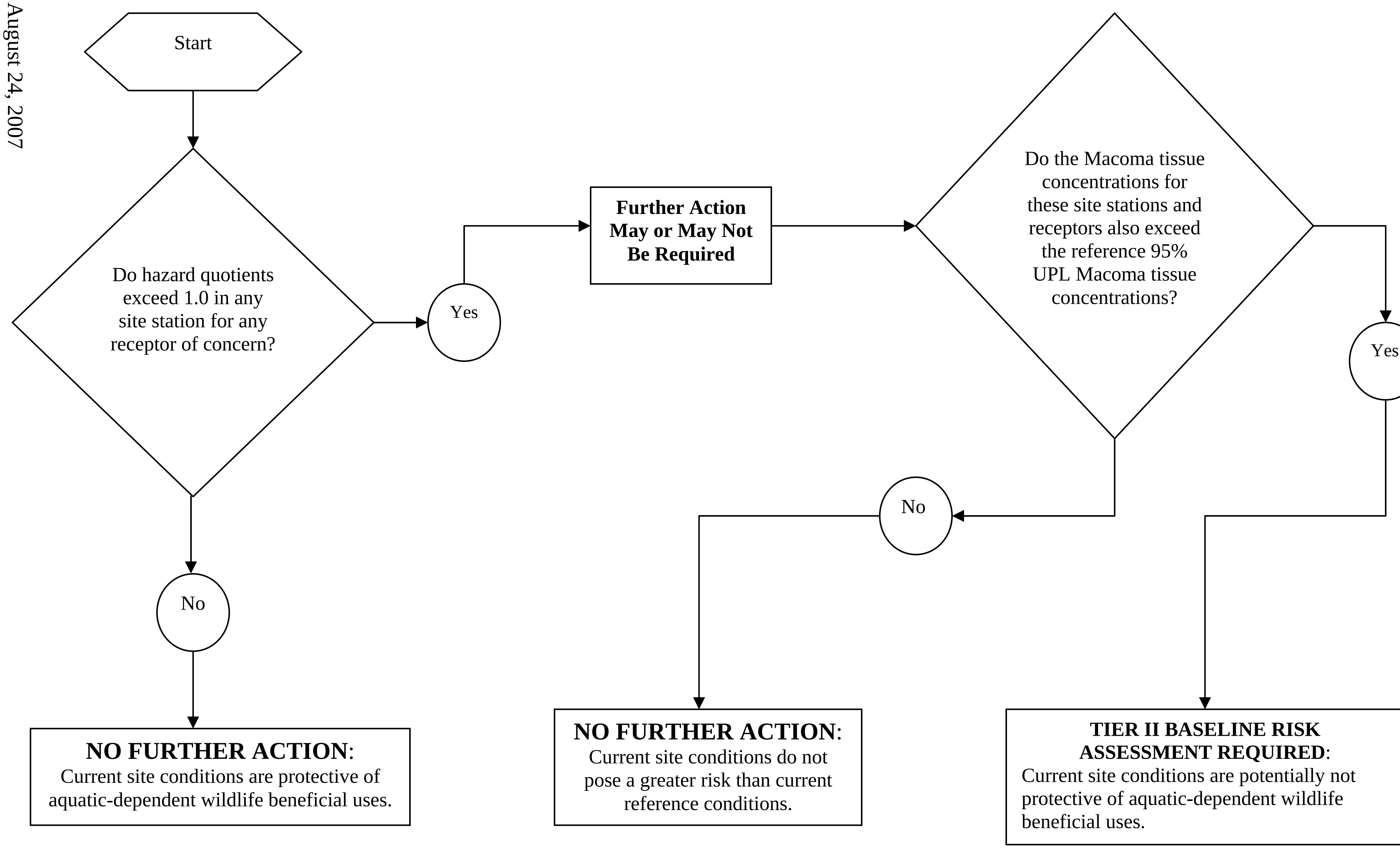

Figure 24-1. Flow Diagram for Tier I Aquatic-Dependent Wildlife Risk Management Decisions

24.2.6 Uncertainties Related to Risk Estimates

The process of evaluating aquatic-dependent wildlife risks involves multiple steps. Inherent in each step of the risk assessment process are uncertainties that ultimately affect the risk estimates. Uncertainties may exist in numerous areas such as estimation of potential site exposures and derivation of toxicity values. The most significant uncertainties in the Tier I risk analysis for the Shipyard Sediment Site are discussed below.

Tissue Chemical Concentrations. For this assessment, a 28-day laboratory bioaccumulation test using the clam *Macoma nasuta* was used to estimate exposure of prey items (fish and shellfish) to chemical pollutants of concern present at the Shipyard Sediment Site. For PCBs, dioxins, furans, PAHs, and metals, 80% of steady state generally occurs using the 28-day bioaccumulation test (U.S. EPA, 1998b; ASTM, 2001). Bioaccumulation testing protocols recommend that the bioaccumulation contaminants of concern reach approximately 80% of steady state tissue residues for a proper risk assessment. While attaining 100% steady state is ideal but not required in Tier I because it is a screening-level risk assessment, the Regional Board recognizes that the observed tissue chemical concentrations in *Macoma nasuta* may be underestimated. Therefore, this may result in an underestimation of risk.

Surrogate for Fish-Eating Receptors. Chemical concentrations in *Macoma* tissue were used as a surrogate to estimate exposures to chemicals in food for all receptors of concern. Use of *Macoma* tissue for the receptors representing fish-eating marine birds and marine mammals (California least tern, California brown pelican, western grebe, and California sea lion) may result in an overestimation of risk because *Macoma* are more directly exposed to contaminants in the surface sediment than fish. *Macoma* actively ingests surface sediment to feed on detritus and also burrows into the sediment.

Exposure Parameters. The exposure parameters selected for Tier I are considered to be conservative values and therefore may result in an overestimation of risk.

Multiple Comparisons. Because multiple comparisons were made to the Baseline Pool, and each comparison carries with it a low probability (5%) of falsely identifying a statistical difference, there is a significant potential for multiple comparison error (SCCWRP and U.S. Navy, 2005b). This may result in an overestimation of risk.

TRV for Reptiles. For this risk assessment, avian TRVs were used as a surrogate for estimating risk to reptiles (specifically, East Pacific green turtle) because no appropriate reptile TRVs could be found for any site chemical of concern (Exponent, 2003). Avian TRVs were selected because birds are considered to be more taxonomically similar to reptiles than are mammals. This may underestimate or overestimate risks to the East Pacific green turtle.

25. Finding 25: Tier II Baseline Comprehensive Risk Assessment for Aquatic-Dependent Wildlife

The Tier II risk assessment objective was to more conclusively determine whether or not Shipyard Sediment Site conditions pose an unacceptable risk to aquatic-dependent wildlife receptors of concern. The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus)*, Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). To focus the risk assessment, prey items were collected within four assessment units at the Shipyard Sediment Site and from a reference area located across the bay from the site. Chemical concentrations measured in fish were used to estimate chemical exposure for the least tern, western grebe, brown pelican, and sea lion and chemical concentrations in benthic mussels and eelgrass were used to estimate chemical pollutant exposure for the surf scoter and green turtle, respectively. Based on the Tier II risk assessment results, ingestion of prey items caught within all four assessment units at the Shipyard Sediment Site poses a risk to all receptors of concern (excluding the sea lion). The chemical in prey tissue posing a risk include benzo[a]pyrene, total PCBs, copper, lead, mercury, and zinc. The Tier II baseline risk assessment was based on tissue measurements from prey items collected from four discrete assessment units at the Shipyard Sediment Site and from a reference area located across San Diego Bay . The prey items collected from these areas included topsmelt (*Atherinops affinis*), anchovies (*Engraulis mordax*), spotted sand bass (*Paralabrax masculatofasciatus*), benthic mussels (*Musculista senhousi*), and eelgrass (*Zostera marina*). Although the Tier I screening level risk assessment identified only six chemicals as “likely” risks to receptors of concern, all chemicals of potential concern were analyzed in the Tier II baseline risk assessment.[112] The Regional Board evaluated the Tier II risk assessment results and concluded that ingestion of the prey items caught within all four assessment units at the Shipyard Sediment Site poses a theoretical risk to all receptors of concern (excluding the East Pacific green turtle). The primary contaminants contributing to the cumulative cancer risk using the toxicity reference values (TRVs) developed by U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) include lead, mercury, and selenium. Because BTAG TRVs were not available for benzo[a]pyrene and chromium, no-observed-adverse-effect level (NOAEL) TRVs were used as a substitute to determine the potential adverse effects from these chemicals of concern. Based on the risk results using the NOAEL TRVs, benzo[a]pyrene and chromium are also considered primary contaminants contributing to the cumulative cancer risk.

[112] Tier II risks were characterized by quantifying the cumulative risks at each of the four assessment units described above for each of the receptors of concern and then comparing those risks to the cumulative risks quantified for each of the receptors of concern at the reference area. An assessment unit was classified as a risk to a receptor of concern when the cumulative risk exceeded both the Hazard Quotient of 1 and reference risk levels.

Summary of Tier II Baseline Risk Assessment Results using the BTAG TRVs

Assessment Unit	BTAG Low	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Inside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (71%)
	Least Tern	Yes	Yes	Yes	Lead (81%)
	Sea Lion	Yes	Yes	Yes	Selenium (36%) Mercury (24%)
	Surf Scoter	Yes	Yes	Yes	Lead (91%)
	Western Grebe	Yes	Yes	Yes	Lead (89%)
Outside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (74%)
	Least Tern	Yes	Yes	Yes	Lead (74%)
	Sea Lion	Yes	Yes	Yes	Selenium (35%) Mercury (24%)
	Western Grebe	Yes	Yes	Yes	Lead (85%)
Inside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (74%)
	Least Tern	Yes	Yes	Yes	Lead (85%)
	Sea Lion	Yes	Yes	Yes	Selenium (42%) Mercury (17%)
	Surf Scoter	Yes	Yes	Yes	Lead (94%)
	Western Grebe	Yes	Yes	Yes	Lead (90%)
Outside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (71%)
	Least Tern	Yes	Yes	Yes	Lead (78%)
	Sea Lion	Yes	Yes	Yes	Selenium (31%) Mercury (26%)
	Western Grebe	Yes	Yes	Yes	Lead (87%)

Note: The East Pacific green turtle was not included in the analysis due to the lack of specific exposure parameters and toxicity reference value.

Summary of Tier II Baseline Risk Assessment Results using the NOAEL TRVs (for benzo[a]pyrene and chromium)

Assessment Unit	NOAEL HQ	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Inside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (49%) PCBs (23%)
	Least Tern	Yes	No	No	Not applicable
	Sea Lion	Yes	Yes	Yes	PCBs (49%) Arsenic (30%)
	Surf Scoter	Yes	Yes	Yes	BAP (32%) Chromium (21%)
	Western Grebe	Yes	Yes	Yes	Chromium (23%) Mercury (21%) PCBs (19%) BAP (17%)
Outside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (53%)
	Least Tern	Yes	No	No	Not applicable
	Sea Lion	No	No	No	Not applicable
	Western Grebe	No	No	No	Not applicable
Inside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (39%) PCBs (23%)
	Least Tern	Yes	Yes	Yes	PCBs (28%) BAP (22%) Mercury (18%)
	Sea Lion	Yes	Yes	Yes	PCBs (49%) Arsenic (31%)
	Surf Scoter	Yes	Yes	Yes	BAP (57%)
	Western Grebe	Yes	Yes	Yes	BAP (26%) PCBs (21%) Mercury (17%)
Outside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (55%) PCBs (19%)
	Least Tern	Yes	Yes	Yes	PCBs (27%) Mercury (24%) BAP (16%)
	Sea Lion	No	No	No	Not applicable
	Western Grebe	Yes	Yes	Yes	Mercury (23%) PCBs (22%) Chromium (17%)

Note: The East Pacific green turtle was not included in the analysis due to the lack of specific exposure parameters and toxicity reference value.

25.1 Tier II Results

For the Tier II risk assessment, six aquatic-dependent wildlife species were identified as potential receptors that could be at risk due to exposure to chemicals in prey caught at the Shipyard Sediment Site. The six receptors include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus),* Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Chemical concentrations measured in fish were used to estimate chemical pollutant exposure for the least tern, western grebe, brown pelican, and sea lion and chemical concentrations in benthic mussels and eelgrass were used to estimate chemical pollutant exposure for the surf scoter and green turtle, respectively.

Based on the Tier II results as summarized in Table 25-1 below, the Regional Board determined that ingestion of prey caught within all four assessment units at the Shipyard Sediment Site poses a risk to all aquatic-dependent wildlife receptors of concern (excluding the sea lion). The chemicals in prey tissue posing a risk include benzo[a]pyrene (BAP), total polychlorinated biphenyls (PCBs), copper, lead, mercury, and zinc. The Tier II risk calculations and results are provided in the Appendix for Section 25.

Table 25-1. Summary of Tier II Aquatic-Dependent Wildlife Risk Assessment Results

Assessment Unit	Receptor	Site Chemicals in Prey Tissue Posing Risk [1]	Site Chemicals in Prey Tissue Not Posing Risk [2]
Inside NASSCO Leasehold	Brown Pelican	PCBs, lead, mercury	BAP, tributyltin (TBT), arsenic, chromium, copper, nickel, selenium, zinc
	Least Tern	PCBs, lead, zinc	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	copper, lead	BAP, PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Western Grebe	lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Green Turtle	lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
Outside NASSCO Leasehold	Brown Pelican	PCBs, lead, mercury	BAP, TBT, arsenic, chromium, copper, nickel, selenium, zinc
	Least Tern	PCBs, lead, zinc	BAP, TBT, arsenic, chromium, copper, mercury nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	PCBs, lead	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc

[1] Hazard Quotient is greater than 1.0 and greater than the reference hazard quotient.
[2] Hazard Quotient is less than 1.0 and less than the reference hazard quotient.

Table 25-1. Summary of Tier II Aquatic-Dependent Wildlife Risk Assessment Results, Continued

Assessment Unit	Receptor	Site Chemicals in Prey Tissue Posing Risk [1]	Site Chemicals in Prey Tissue Not Posing Risk [2]
Inside BAE Systems Leasehold	Brown Pelican	PCBs, lead, mercury	BAP, TBT, arsenic, chromium, copper, nickel, selenium, zinc
	Least Tern	PCBs, lead, zinc	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Surf Scoter	BAP, copper, lead	PCBs, TBT, arsenic, chromium, mercury, nickel, selenium, zinc
	Western Grebe	PCBs, lead	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
	Green Turtle	lead	BAP, PCBs, TBT, arsenic, chromium, copper, mercury, nickel, selenium, zinc
Outside BAE Systems Leasehold	Brown Pelican	PCBs, lead, mercury	BAP, TBT, arsenic, chromium, copper, nickel, selenium, zinc
	Least Tern	PCBs, lead, zinc	BAP, TBT, arsenic, chromium, copper, mercury, nickel, selenium
	Sea Lion	NONE	BAP, PCBs, TBT, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc
	Western Grebe	PCBs, lead	BAP, TBT, arsenic, chromium, copper, mercury nickel, selenium, zinc

[1] Hazard Quotient is greater than 1.0 and greater than the reference hazard quotient.
[2] Hazard Quotient is less than 1.0 and less than the reference hazard quotient.

25.2 Tier II Approach

The Regional Board conducted a Tier II ecological risk assessment (i.e., baseline risk assessment) to more conclusively determine whether or not the current conditions at the Shipyard Sediment Site pose unacceptable risks to aquatic-dependent wildlife receptors of concern and to identify the need for remedial action. Risks were characterized by: (1) quantifying the risks at the site, and (2) comparing the site risks to the risks calculated at the reference areas.

The approach used in the baseline risk assessment was conducted in accordance with U.S. EPA's "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final)" (U.S. EPA, 1997a) and with California Department of Toxic Substances Control's "Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities" (DTSC, 1996). The approach consists of the following key elements:

- Selection of Receptors of Concern
- Exposure Characterization
- Effects Characterization
- Risk Characterization
- Risk Management
- Uncertainties Related to Risk Estimates

These key elements are discussed in more detail below.

25.2.1 Selection of Receptors of Concern

For Tier II, fish-eating marine birds and mammals, mollusk-eating birds, and sea grass-eating reptiles were identified as important groups of aquatic-dependent wildlife that could be at risk due to exposure to chemicals in prey species at the Shipyard Sediment Site (Exponent, 2003). Six species were identified as suitable representative receptors for assessing potential risk to these groups as reviewed and approved by U.S. Fish and Wildlife (USFW), California Department of Fish and Game (DFG), and National Oceanic and Atmospheric Administration (NOAA) (collectively known as the "Natural Resource Trustee Agencies"). The six species are shown in Table 25-2 below. These receptors were selected based on characteristics such as their presence at the site, feeding habits, known adverse effects from exposure to bioaccumulative contaminants, the availability of ample life history information in the literature, and federal or state listings of species as threatened or endangered.

Table 25-2. Receptors Selected for the Tier II Risk Assessment

Receptor	Scientific Name	Representative of	Comments
California least tern	*Sterna antillarum brownie*	Marine birds that may feed on small fish	Federal and California listed endangered species
California brown pelican	*Pelecanus occidentalis californicus*	Marine birds that may feed on small- to medium-sized fish	Federal and California listed endangered species
Western grebe	*Aechmophorus occidentalis*	Diving marine birds that may feed on small fish	
Surf scoter	*Melanitta perspicillata*	Diving marine birds that may feed on mollusks	
California sea lion	*Zalophus californianus*	Marine mammals that may feed on medium-sized fish	
East Pacific green turtle	*Chelonia mydas agassizii*	Marine reptiles that may feed on sea grasses	Listed as threatened wherever found and listed as endangered in Florida and on the Pacific coast of Mexico

25.2.2 Exposure Characterization

To focus the baseline risk assessment, the Shipyard Sediment Site was divided into four discrete assessment units to identify areas with a greater likelihood for adverse ecological effects to the receptors of concern (Exponent, 2003):

- Inside NASSCO – the area inside the NASSCO leasehold
- Outside NASSCO – the area between the NASSCO leasehold and the shipping channel
- Inside BAE Systems – the area inside the BAE Systems leasehold
- Outside BAE Systems – the area between the BAE Systems leasehold and the shipping channel.

The primary routes of exposure to pollutants at the Shipyard Sediment Site are through the ingestion of prey items and the incidental ingestion of sediment during foraging (Exponent, 2003). Separate chemical pollutant exposure estimates were developed for each receptor in each of the four assessment units using prey tissue and sediment chemical pollutant data collected at the Shipyard Sediment Site. The following prey items were used to estimate exposure to chemical pollutants in food for the receptors of concern:

Table 25-3. Prey Items Used in the Tier II Risk Assessment

Receptor	Prey Item	Scientific Name	Areas Collected
California least tern	Topsmelt	*Atherinops affinis*	Inside NASSCO
	Anchovies	*Engraulis mordax*	Outside NASSCO Inside/outside SWM
California brown pelican	Spotted sand bass	*Paralabrax masculatofasciatus*	Inside/outside NASSCO Inside/outside SWM
Western grebe	Topsmelt	*Atherinops affinis*	Inside NASSCO
	Anchovies	*Engraulis mordax*	Outside NASSCO Inside/outside SWM
Surf scoter	Benthic Mussels	*Musculista senhousei*	Inside NASSCO Inside SWM
California sea lion	Spotted sand bass	*Paralabrax masculatofasciatus*	Inside/outside NASSCO Inside/outside SWM
East Pacific green turtle	Eelgrass	*Zostera marina*	Inside NASSCO Inside SWM

Exposure estimates for the six receptors were developed using the following general intake equation (DTSC, 1996):

$$\textbf{Daily Intake}_{\textbf{chemical}} = \textbf{(CM x CR x FI x AF) / BW}$$

where:

CM	=	Concentration of the chemical in a given dietary component or inert medium (mg/kg)
CR	=	Contact rate (i.e., ingestion rate) of dietary component or inert medium (kg/day)
FI	=	Fraction of the daily intake of a given dietary component or inert medium derived from the site (unitless area-use factor)
AF	=	Relative gastrointestinal absorption efficiency for the chemical in a given dietary component or inert medium (fraction)
BW	=	Body weight of receptor species (kg)

The intake equation was further expanded to account for the ingestion of prey items and the incidental ingestion of sediment:

$$\textbf{Daily Intake}_{\textbf{chemical}} = \textbf{[(CM x CR x FI x AF)}_{\textbf{prey}} \textbf{ + (CM x CR x FI x AF)}_{\textbf{sediment}}\textbf{]/BW}$$

The assumptions used by the Regional Board in the expanded equation to estimate receptor exposure at each assessment unit are shown in Table 25-4 below and the exposure estimate calculations using these assumptions are provided in the Appendix for Section 25.

Table 25-4. Exposure Parameters for Tier II Baseline Risk Assessment

Receptor	Prey Tissue Concentration (mg/kg dry wt)	Sediment Chemical Concentration (mg/kg dry wt)	Body Weight (kg)	Food Ingestion Rate (kd/day dry wt)	Sediment Ingestion Rate (kg/day dry wt)	Area Use Factor	Absorption Efficiency
California brown pelican	Mean Detected Value	Mean Detected Value	2.845[a]	0.23[b]	0.005	1	1
California least tern	Mean Detected Value	Mean Detected Value	0.036[c]	0.044[d]	0.0011	1	1
Western grebe	Mean Detected Value	Mean Detected Value	0.808[e]	0.046[d]	0.0031	1	1
Surf scoter	Mean Detected Value	Mean Detected Value	0.859[f]	0.048[d]	0.0028	1	1
California sea lion	Mean Detected Value	Mean Detected Value	45.0[g]	0.99[h]	0.0308	1	1
East Pacific green turtle	Mean Detected Value	Mean Detected Value	95[i]	0.31[j]	0.0186	1	1

[a] Mean female weight minus 1 standard deviation from Dunning (1993).
[b] Based on Nagy et al. (1999) equation for Pelecaniformes.
[c] Minimum adult body weight from Thompson et al. (1997).
[d] Based on U.S. EPA (1993a) equation for non-passerine birds.
[e] Minimum female body weight from Storer and Nuechterlein (1992).
[f] Minimum average female weight, as cited in Savard et al. (1998).
[g] Minimum female weight from Whitaker (1997).
[h] Based on Nagy et al. (1999) equation for Carnivora.
[i] Median adult weight from Cornelius (1986).
[j] Based on data in Bjorndal (1980).

25.2.3 Effects Characterization

Characterizing potential adverse effects to the receptors of concern requires a comparison of the receptor-specific exposure estimates to an appropriate toxicity reference value (TRV). As recommended by the Natural Resource Trustee Agencies, exposure estimates for the baseline risk assessment were compared to TRVs developed by the U.S. Navy/U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) (DTSC, 2000). The BTAG TRVs were developed jointly by the U.S. Navy, Navy consultants, and regulatory agencies, including the U.S. EPA, California Department of Toxic Substances Control – Human and Ecological Risk Division (DTSC), Regional Water Quality Control Board, NOAA, USFW, Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA), and DFG. The U.S. EPA, DTSC, and the other agencies endorse and recommend the use of the BTAG TRVs for ecological risk assessments conducted in California and in U.S. EPA Region 9.

The BTAG TRVs are presented as an upper and lower estimate of effects thresholds. The low-TRV is based on no-adverse-effects-levels (NOAELs) and represents a threshold below which no adverse effects are expected. The high-TRV is based on an approximate midpoint of the range of effects levels and represents a threshold above which adverse effects are likely to occur. The BTAG low and high TRVs for birds and mammals (site chemicals of concern only) are shown in Table 25-5 below. Because BTAG TRVs are not available for benzo[a]pyrene for birds and chromium for birds and mammals, the NOAELs and low-adverse-effects-levels (LOAELs) identified by Exponent (2003) were used (Table 25-6). It should be noted that suitable reptilian TRVs were not found in the literature (Exponent, 2003). Therefore, avian TRVs were used to estimate potential adverse effects to the East Pacific green turtle.

Table 25-5. U.S. Navy/U.S. EPA Region 9 BTAG Toxicity Reference Values for Birds and Mammals (Shipyard Chemicals of Concern Only)

	Birds		Mammals	
Chemical	**Low TRV (mg/kg-day)**	**High TRV (mg/kg-day)**	**Low TRV (mg/kg-day)**	**High TRV (mg/kg-day)**
Arsenic	5.5	22.0	0.32	4.7
Benzo[a]pyrene	NA	NA	1.31	32.8
Butyltins	0.73	45.9	0.25	15
Cadmium	0.08	10.4	0.06	2.64
Chromium	NA	NA	NA	NA
Copper	2.3	52.3	2.67	632
Lead	0.014	8.75	1.0	241
Mercury	0.039	0.18	0.027	0.27
	NA	NA	0.25	4.0
Nickel	1.38	56.3	0.133	31.6
PCBs	0.09	1.27	0.36	1.28
Selenium	0.23	0.93	0.05	1.21
Zinc	17.2	172	9.6	411

NA – not available

Table 25-6. NOAELs and LOAELs for Benzo[a]pyrene and Chromium Identified by Exponent

	Birds		Mammals	
Chemical	**NOAEL (mg/kg-day)**	**LOAEL (mg/kg-day)**	**NOAEL (mg/kg-day)**	**LOAEL (mg/kg-day)**
Benzo[a]pyrene	0.14	1.4	Not Used	Not Used
Chromium	0.86	4.3	3.3	69

(Exponent, 2003)

25.2.4 Risk Characterization

For the baseline risk assessment, the Regional Board characterized potential risks of adverse effects to the receptors of concern by quantifying the risks at each of the four assessments. Risks were estimated by integrating the exposure and effects assessments in Sections 25.2.2 and 25.2.3 above using the hazard quotient approach:

$$\mathbf{HQ_{low} = IR_{chemical} / TRV_{low}}$$

$$\mathbf{HQ_{high} = IR_{chemical} / TRV_{high}}$$

where:

HQ	=	Hazard Quotient (unitless)
$IR_{chemical}$	=	Total ingestion rate of the chemical (mg/kg body weight-day)
TRV	=	BTAG low or high toxicity reference value (mg/kg body weight-day)

An HQ value less than 1.0 indicates that the chemical is unlikely to cause adverse ecological effects to the receptor of concern. An HQ value greater than 1.0 indicates that the receptor's exposure to the chemical pollutant has exceeded the TRV, which could indicate that there is a potential that some fraction of the population may experience an adverse effect (Exponent, 2003). The HQ calculations and risk characterization results for each receptor of concern at each assessment unit are provided in the Appendix for Section 25.

In addition to characterizing the risks at the Shipyard Sediment Site, risks were also characterized at a reference area to determine whether or not the site poses a greater risk to the receptors of concern than reference conditions in San Diego Bay. The reference area, located in the vicinity of Reference Station 2240, is located across the bay from the Shipyard Sediment Site (Exponent, 2003). Spotted sand bass, topsmelt, anchovies, benthic mussels, and eelgrass were collected from this reference area and the chemical concentrations from these prey items were used to estimate exposure to the receptors of concern. Risks at the reference area were calculated using the same chemicals of concern, exposure assumptions, and TRVs as those identified above for the Shipyard Sediment Site. The HQ calculations and risk characterization results for the reference area are provided in the Appendix for Section 25.

25.2.5 Risk Management

The Regional Board identified two risk management decisions: (1) Current site conditions pose acceptable risks and no further action is warranted, and (2) Current site conditions pose unacceptable risks that require remedial action. These two management decisions are based on the risk characterization results at the Shipyard Sediment Site and at the reference area. A flow diagram showing how each management decision is triggered is shown below.

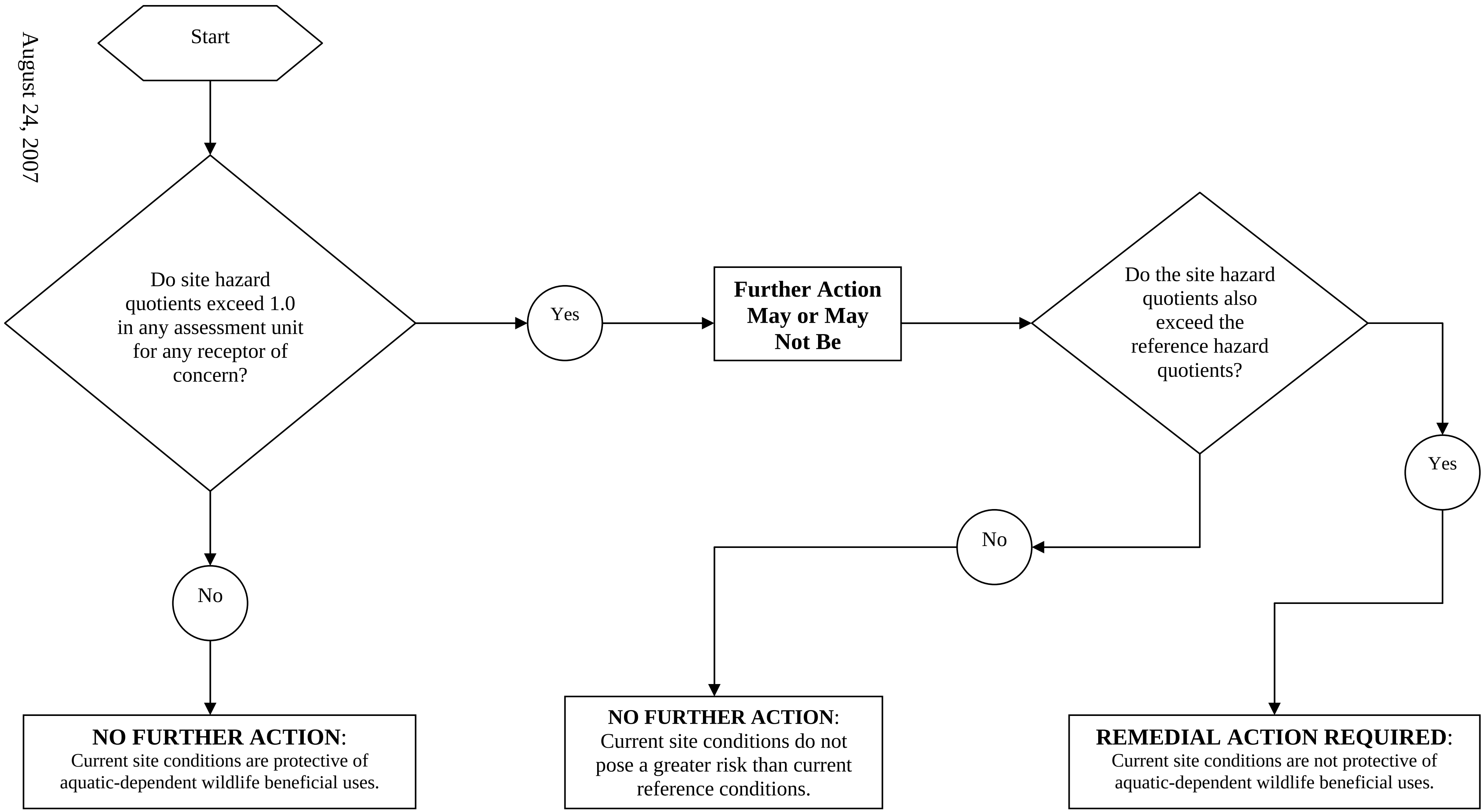

Figure 25-1. Flow Diagram for Tier II Aquatic-Dependent Wildlife Risk Management Decisions

25.2.6 Uncertainties Related to Risk Estimates

The process of evaluating aquatic-dependent wildlife risk involves multiple steps. Inherent in each step of the risk assessment process are uncertainties that ultimately affect the risk estimates. Uncertainties may exist in numerous areas such as estimation of potential site exposures and derivation of toxicity values. The most significant uncertainties in the Tier II risk analysis for the Shipyard Sediment Site are discussed below.

Area Use Factor. Exponent used the following area use factors for the aquatic-dependent wildlife risk assessment:

Table 25-7. Area Use Factors Identified by Exponent

Receptors	Area Use Factor			
	Inside NASSCO	Outside NASSCO	Inside SWM	Outside SWM
East Pacific green turtle	1.1%	1.6%	0.6%	0.6%
California least tern	0.3%	0.4%	0.2%	0.2%
California brown pelican	0.4%	0.5%	0.2%	0.2%
Western grebe	0.4%	0.5%	0.2%	0.2%
Surf Scoter	0.4%	0.5%	0.2%	0.2%
California Sea Lion	0.4%	0.6%	0.2%	0.2%

(Exponent, 2003)

In contrast, the Regional Board assumed that 100% of the prey items (fish, shellfish, and sea grass) caught and consumed by the receptors of concern are from the Shipyard Sediment Site. While it is possible that these receptors could catch their prey from other locations in San Diego Bay, thus reducing their area use factor, the Regional Board considers anything less than 100% as not providing full protection of San Diego Bay beneficial uses. The objective of the aquatic-dependent wildlife risk assessment is to determine whether or not the Wildlife Habitat (WILD), Preservation of Biological Habitats of Special Significance (BIOL), and Rare, Threatened, or Endangered Species (RARE) beneficial uses at the Shipyard Sediment Site are impaired. Protection of WILD, BIOL, and RARE is interpreted to mean that the prey items at the Shipyard Sediment Site should be safe to eat at typical ingestion rates for the receptors of concern. WILD, BIOL, and RARE would not be considered fully protected if a receptor is limited to only consuming prey items from a site a fraction of the time (e.g., only 0.5 percent of the time). A fractional intake of 100% is considered to be conservative yet reasonably protective of aquatic dependent wildlife beneficial uses.

TRV for Reptiles. For this risk assessment, avian TRVs were used as a surrogate for estimating risk to reptiles (specifically, East Pacific green turtle) because no appropriate reptile TRVs could be found for any site chemical of concern (Exponent, 2003). Avian TRVs were selected because birds are considered to be more taxonomically similar to reptiles than are mammals. This may underestimate or overestimate risks to the East Pacific green turtle.

Fish Home Range. Spotted sand bass, topsmelt, and anchovies were collected in four discrete assessment units at the Shipyard Sediment Site: inside NASSCO leasehold, outside NASSCO leasehold, inside BAE Systems leasehold, and outside BAE Systems leasehold. It is assumed that the assessment units bound the home range for these fish and that the observed tissue chemical concentrations are based exclusively from exposure within these areas. This may, however, not be indicative of their actual exposures because these fish may feed beyond the assessment unit boundaries. Therefore, the estimated risk to the receptors of concern ingesting the fish is considered conservative and does not characterize actual exposures to the Shipyard Sediment Site.

Composite Prey Samples. Forage fish and mussel samples were composited within each assessment unit to provide an adequate sample size for analytical purposes (Exponent, 2003). This is considered to be representative of the actual exposure received by the receptors of concern because they would typically catch and consume a wide range of prey across each unit. However, compositing may reduce the contribution of the most highly contaminated prey items ingested in the exposure assessment.

Mean Chemical Concentrations. The exposure estimates in this risk assessment are based on mean chemical concentrations in prey items and incidentally ingested sediment. This reflects spatial variation in chemical concentrations across each assessment unit and represents the actual exposure received by the receptors of concern utilizing the entire assessment unit while foraging for prey. This may, however, reduce the contribution of the most highly contaminated prey items ingested in the exposure assessment.

26. Finding 26: Human Health Impairment

Human health beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Human health beneficial uses include: Contact Water Recreation (REC-1), Non-contact Water Recreation (REC-2), Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM). This finding is based on the considerations described below in this *Impairment Of Human Health Beneficial Uses* section of the Cleanup and Abatement Order.

26.1 Human Health Beneficial Uses

There are four beneficial uses designated in the Basin Plan for San Diego Bay (RWQCB 1994), which must be fully protected in order to provide for the protection of human health:

- **Contact Water Recreation (REC-1) –** Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs;
- **Non-contact Water Recreation (REC-2) –** Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities;
- **Shellfish Harvesting (SHELL) –** Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes; and
- **Commercial and Sport Fishing (COMM) –** Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

The concentrations of the pollutants present in the marine sediment within and adjacent to the Shipyard Sediment Site causes or threatens to cause a condition of pollution or contamination that adversely impacts these four beneficial uses and thereby constitutes a threat to the public health. Information supporting this conclusion is contained in Sections 27 through 28 of this Technical Report.

27. Finding 27: Risk Assessment Approach for Human Health

The Regional Board evaluated potential risks to human health from chemical pollutants present in the sediment at the Shipyard Sediment Site based on a two-tier approach. ~~The Regional Board's assessment of potential human health risks from pollutants present in the Shipyard Sediment Site was based on a two-tier approach. This approach used a fractional intake (FI) of 1 and other conservative assumptions.~~ The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using American Society of Testing Material (ASTM) protocols. The Tier II comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. Two types of receptors (i.e., members of the population or individuals at risk) were evaluated:

a. Recreational Anglers – Persons who eat the fish and/or shellfish they catch recreationally; and

b. Subsistence Anglers – Persons who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in their diet.

27.1 Human Health Risk Assessment Approach

A two-tiered approach was used to evaluate potential risks to human health from chemical pollutants present at the Shipyard Sediment Site. The Tier I screening level risk assessment used conservative exposure and effects assumptions to support risk management decisions. The Tier II comprehensive risk assessment (i.e., baseline risk assessment) more accurately characterized potential risk to receptors of concern primarily by replacing the conservative assumptions required by Tier I with site-specific exposure parameters.

The approach used in Tiers I and II was conducted in accordance with U.S. EPA's "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)" (U.S. EPA, 1989b). The approach consists of the following key elements:

- Identification of Chemicals of Potential Concern;
- Exposure Assessment;
- Toxicity Assessment;
- Risk Characterization;
- Risk Management; and
- Uncertainties Related to Risk Estimates.

These elements are discussed in more detail in Section 28 – Tier I Screening Level Risk Assessment for Human Health and Section 29 – Tier II Baseline Risk Assessment for Human Health of this Technical Report.

28. Finding 28: Tier I Screening Level Risk Assessment for Human Health

The Tier I risk assessment objectives were to determine whether or not Shipyard Sediment Site conditions potentially pose an potential unacceptable risk to human health recreational and subsistence anglers, and to identify if whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The receptors of concern identified for Tier I are recreational anglers and subsistence anglers. Recreational anglers represent those who eat the fish and/or shellfish they catch recreationally and subsistence anglers represent those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet. Chemical concentrations measured in *Macoma nasuta* tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure for these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk to recreational and subsistence anglers ingesting fish and shellfish caught at the Shipyard Sediment Site. The chemicals in *Macoma* tissue posing a potential risk include arsenic, BAP, PCBs, and TBT. Tier I was based on clam (*Macoma nasuta*) tissue concentrations derived from 28-day laboratory bioaccumulation tests. Potential risks were characterized by comparing *Macoma nasuta* tissue concentrations from nine Shipyard Sediment Site stations to:

a. Tissue residue guidelines published by the California Office of Environmental Health Hazard, and

b. The 95% upper prediction limits (UPL) calculated from the Baseline Pool *Macoma nausta* tissue concentrations.

A Shipyard Sediment Site station was classified as a "possible" risk when one or more chemicals in the *Macoma nasuta* tissue exceeded both the TRGs and the 95% UPL thresholds. Based on the Tier I results, the Regional Board concluded that *Macoma nasuta* tissue data at eight of nine shipyard stations with *Macoma nasuta* tissue data were at levels that constituted a "possible" human health risk, subject to confirmation in a Tier II human health risk assessment study. The chemical pollutants of concern found to pose a "possible" cancer risk to both recreational and subsistence anglers include inorganic arsenic, benzo[a]pyrene, and total PCBs; tributyltin was determined to be a "possible" cancer risk to subsistence anglers only. PCBs were found to pose a "possible" non-cancer risk to both recreational and subsistence anglers; inorganic arsenic was found to pose a "possible" non-cancer risk to subsistence anglers.

Summary of Tier I Screening Level Risk Assessment Results for Recreational Anglers

Station	Contaminants Posing "Possible" Cancer Risk	Contaminants Posing "Possible" Non-Cancer Risk
NA06	PCBs, benzo[a]pyrene	PCBs
NA11	benzo[a]pyrene	None
NA20	benzo[a]pyrene	None
SW04	PCBs, benzo[a]pyrene, inorganic arsenic	PCBs
SW08	PCBs, benzo[a]pyrene	PCBs
SW13	PCBs, benzo[a]pyrene	PCBs
SW21	PCBs, benzo[a]pyrene	PCBs
SW28	PCBs, benzo[a]pyrene	PCBs

Summary of Tier I Screening Level Risk Assessment Results for Subsistence Anglers

Station	Contaminants Posing "Possible" Cancer Risk	Contaminants Posing "Possible" Non-Cancer Risk
NA06	PCBs, benzo[a]pyrene	PCBs
NA11	benzo[a]pyrene	None
NA20	benzo[a]pyrene	None
SW04	PCBs, tributyltin, benzo[a]pyrene, norganic arsenic	PCBs, inorganic arsenic
SW08	PCBs, tributyltin, benzo[a]pyrene	PCBs
SW13	PCBs, benzo[a]pyrene	PCBs
SW21	PCBs, benzo[a]pyrene	PCBs
SW28	PCBs, benzo[a]pyrene	PCBs

28.1 Tier I Results

For the Tier I screening level risk assessment, recreational anglers and subsistence anglers were identified as potential receptors that could be at risk due to exposure of chemical pollutants in fish and shellfish caught at the Shipyard Sediment Site. Recreational anglers represent those who eat the fish and/or shellfish they catch recreationally and subsistence anglers represent those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet. Chemical concentrations measured in *Macoma nasuta* tissue derived from laboratory bioaccumulation tests were used to estimate chemical pollutant exposure for these receptors of concern.

Based on the Tier I results as summarized in Table 28-1 below, the Regional Board determined that there was a potential risk to recreational and subsistence anglers ingesting fish and shellfish caught at the Shipyard Sediment Site and that a Tier II baseline risk assessment was warranted. The chemicals in *Macoma* tissue posing a potential risk include arsenic, benzo[a]pyrene (BAP), total polychlorinated biphenyls (PCBs), and tributyltin (TBT). The Tier I calculations and results are provided in the Appendix for Section 28.

Table 28-1. Summary of Tier I Human Health Risk Assessment Results.

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing Risk [2]
NA06	Recreational Angler	Benzo[a]pyrene (BAP), total polychlorinated biphenyls (PCBs)	Tributyltin (TBT), arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
NA11	Recreational Angler	BAP	PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP	PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
NA12	Recreational Angler	NONE	BAP, PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	NONE	BAP, PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
NA20	Recreational Angler	BAP	PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP	PCBs, TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
SW04	Recreational Angler	BAP, PCBs, arsenic	TBT, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs, TBT, arsenic	Cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc

Station	Receptor	Site Chemicals in *Macoma* Tissue Posing a Potential Risk [1]	Site Chemicals in *Macoma* Tissue Not Posing Risk [2]
SW08	Recreational Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs, TBT	Arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
SW13	Recreational Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
SW21	Recreational Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
SW28	Recreational Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc
	Subsistence Angler	BAP, PCBs	TBT, arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, zinc

[1] Site Macoma tissue concentration greater than risk-based tissue screening level and greater than the reference 95% upper prediction limit Macoma tissue concentration.

[2] Site Macoma tissue concentration less than risk-based tissue screening level and less than the reference 95% upper prediction limit Macoma tissue concentration OR site Macoma tissue concentration greater than risk-based tissue screening level and less than the reference 95% upper prediction limit Macoma tissue concentration

28.2 Tier I Approach

The Regional Board conducted a Tier I screening level risk assessment to determine whether or not the current conditions at the Shipyard Sediment Site pose a potential unacceptable risk to human health and to whether or not a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). Potential risks were characterized by: (1) comparing clam tissue concentrations exposed to site sediment to tissue screening values published by the California Office of Environmental Health Hazard (OEHHA), and (2) comparing clam tissue concentrations exposed to site sediment to clam tissue concentrations exposed to reference sediment.

The approach used in the Tier I screening level risk assessment was conducted in accordance with U.S. EPA's "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)" (U.S. EPA, 1989b) and in consultation with OEHHA. The approach consists of the following key elements:

- Exposure Assessment;
- Toxicity Assessment;
- Risk Characterization;
- Risk Management; and
- Uncertainties Related to Risk Estimates.

These key elements are discussed in more detail below.

28.2.1 Exposure Assessment

Human exposure to contaminated marine sediment can occur around three principal pathways:

- Direct contact of contaminated marine sediment by swimmers or divers;
- Incidental ingestion of contaminated marine sediment or associated waters by swimmers or divers; and
- Bioaccumulation and food chain transfer of sediment pollutants to human consumers of contaminated fish and shellfish.

The most significant theoretical human health risk associated with contaminated marine sediment is considered to be the ingestion, over time, of fish and shellfish that may have bioaccumulated chemical pollutants either directly from marine sediment or through the food web (Long, 1989). U.S. EPA literature suggests that even when conservative assumptions about direct human exposure are used, risks associated with dermal contact and incidental ingestion of contaminated sediment are minimal and contribute less to the total risk than the fish and shellfish consumption pathway. The human health risks associated with fish and shellfish consumption often constitute the greatest proportion of the total risk, and sometimes drive the human health risk assessment (U.S. EPA, 1992b).

28.2.1.1 Shipyard Sediment Site Exposure Assessment

The most significant potential source of human exposure to pollutants at the Shipyard Sediment Site is through consumption of fish and shellfish that may have bioaccumulated chemicals either directly from site sediment or through the food web (Exponent, 2003). Direct contact with sediment pollutants at the Shipyard Sediment Site is not a likely exposure pathway to humans because the industrial nature of the site and the lack of a beach (shoreline at Shipyard Sediment Site consists almost exclusively of riprap, sheet-pile bulkhead, and piers) make swimming and wading a highly unlikely event. Therefore, two types of receptors (i.e., members of the population or individuals at risk) were identified and further evaluated in the Tier I screening level risk assessment:

1. Recreational Angler - represents those who eat the fish and/or shellfish they catch recreationally.
2. Subsistence Angler - represents those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet.

Exponent reported that public fishing and shellfish harvesting are currently unlikely events at the Shipyard Sediment Site due to the current security measures. Under the current site usage, there are security measures in place at both the upland property and the in-water leaseholds of NASSCO and BAE Systems due to the work performed on U.S. Navy ships (Exponent, 2003). Force protection measures, required for U.S. Navy vessels, prohibit non-mission-essential vessels from approaching U.S. Navy ships. A security boom prevents unauthorized vessels from approaching closer than 300 feet in the NASSCO and BAE Systems leaseholds. Furthermore, armed personnel are present at all times to ensure that no trespassing occurs at the site.

Despite these factors the Regional Board, as discussed with OEHHA, required a screening level risk assessment using the two receptors identified above based on the following considerations (Brodberg, 2004):

- NASSCO and BAE Systems employees or U.S. Navy personnel may fish off of the piers, bulkhead, riprap, ships, etc.;
- NASSCO and BAE Systems may not occupy the site in the future and future site usage may allow for fishing. This scenario recently occurred at a former shipyard (Campbell Shipyard) located in San Diego Bay just north of the Shipyard Sediment Site;
- Chemical pollutants within the NASSCO and BAE Systems leaseholds may migrate to areas outside the leasehold where fishing by boat and fishing at a nearby public pier (Crosby Street Park Pier located approximately ½ mile north of BAE Systems just past the Coronado Bridge) is accessible; and
- The Regional Board's statutory responsibility is to protect the beneficial uses designated for San Diego Bay. The beneficial uses pertaining to human health are Commercial and Sport Fishing (COMM) and Shellfish Harvesting (SHELL). These beneficial uses are to be protected at all times regardless of the current site-access measures that prevent the uses from occurring.

For Tier I, the tissue concentrations derived from the laboratory bioaccumulation tests were used to represent the chemical pollutant exposures for the recreational and subsistence anglers. The bioaccumulation tests involved the exposure of the clam *Macoma nasuta* to site sediment for 28 days using the protocols specified by ASTM (2001). Sediment was collected from four stations in the NASSCO leasehold (NA06, NA11, NA12, and NA20) and five stations in the BAE Systems leasehold (SW04, SW08, SW13, SW21, and SW28). These stations were positioned along an expected gradient of sediment concentrations of potentially bioaccumulative substances at each shipyard. Because *Macoma* actively ingests surface sediment (likely to be the most direct route of exposure to sediment pollutants that accumulate in tissues), use of *Macoma* tissue data for estimating exposure to the receptors of concern is considered a conservative approach.

The *Macoma* tissue concentrations from each site station were compared to risk-based screening values developed by OEHHA (Brodberg and Pollock, 1999). These screening levels were developed for two California lakes, San Pablo Reservoir and Black Butte Reservoir, to determine whether additional sampling and health evaluations were warranted. While these screening levels were derived for two freshwater bodies, OEHHA (Brodberg, 2004) has indicated that the screening levels are applicable for chemicals in all fish and water bodies (i.e., freshwater, estuarine, and marine). For site chemical pollutants of concern that do not have screening values published by OEHHA, the Regional Board derived screening values for these chemical pollutants using the same equations and assumptions used by OEHHA. Additionally, because the screening value assumptions used by OEHHA were considered more applicable to recreational anglers (specifically due to the consumption rate of 21 g/day), the Regional Board developed a separate set of screening values for subsistence anglers (using a consumption rate of 161 g/day).

For noncarcinogenic chemical pollutants, screening values were derived using the following equation:

$$\mathbf{SV_{noncarcinogenic} = (RfD \times BW) / (CR \times FI)}$$

where:

SV	=	tissue screening value for fish/shellfish tissue (µg/kg wet)
RfD	=	reference dose (mg/kg-day)
BW	=	body weight of adult (kg)
CR	=	fish and shellfish consumption rate (g/day)
FI	=	fractional intake of seafood consumed that originates from site (unitless)

For carcinogenic chemicals, screening values were derived using the following:

$$\mathbf{SV_{carcinogenic} = (TRL \times BW) / (CSF \times CR \times FI \times ABS)}$$

where:

SV	=	tissue screening value for fish/shellfish tissue (µg/kg wet)
TRL	=	target risk level (unitless)
BW	=	body weight of adult (kg)
CSF	=	Carcinogenic slope factor $(mg/kg\text{-}day)^{-1}$
CR	=	fish and shellfish consumption rate (g/day)
FI	=	fractional intake of seafood consumed that originates from site (unitless)
ABS	=	fraction absorbed (unitless)

The Regional Board used the following exposure parameters (Table 28-2), in consultation with OEHHA, to develop the noncarcinogenic and carcinogenic screening values presented in the risk characterization section below.

Table 28-2. Exposure Parameters for Screening Level Development in the Tier I Human Health Risk Assessment

	Units	Recreational Angler	Subsistence Angler
Noncarcinogenic Chemicals			
Body Weight of Adult	kg	70	70
Consumption Rate (a)	g/day	21	161[a]
Fractional Intake	kg/day dry wt	1	1
RfD	mg/kg-day	See Toxicity Assessment Section	See Toxicity Assessment Section
Carcinogenic Chemicals			
Target Risk Level	unitless	1×10^{-5}	1×10^{-5}
Body Weight of Adult	kg	70	70
Consumption Rate	g/day	21	161[a]
Fractional Intake	unitless	1	1
Fraction Absorbed	unitless	1	1
CSF	$(mg/kg\text{-}day)^{-1}$	See Toxicity Assessment Section	See Toxicity Assessment Section

[a] SCCWRP and MBC, 1994

28.2.2 Toxicity Assessment

Reference doses (RfDs) for noncarcinogenic chemicals and cancer slope factors (CSFs) for carcinogenic chemicals were used when it was necessary to derive screening values for the Tier I risk analysis. The RfDs and CSFs were selected from U.S. EPA's Integrated Risk Information System (IRIS) with the exception of the carcinogenic PAHs (U.S. EPA, 2003a). For the carcinogenic PAHs, CSFs were used from the California Environmental Protection Agency (OEHHA, 2001). The RfDs and CSFs are listed in Table 28-3 below.

Table 28-3. Toxicity Criteria Used to Develop Human Health Tissue Screening Values

Chemical	CSF (mg/kg-day)	RfD (mg/kg-day)	Source
Metals			
Arsenic, inorganic	1.5	0.0003	U.S. EPA (2003a)
Cadmium	NA	0.0005	U.S. EPA (2003a)
Chromium	NA	0.003	U.S. EPA (2003a)
Copper	NA	0.037	U.S. EPA (2003a)
Mercury, total	NA	0.0001	U.S. EPA (2003a)
Nickel	NA	0.02	U.S. EPA (2003a)
Selenium	NA	0.005	U.S. EPA (2003a)
Silver	NA	0.005	U.S. EPA (2003a)
Zinc	NA	0.3	U.S. EPA (2003a)
Organometallic Compounds			
Tributyltin	NA	0.0003	U.S. EPA (2003a)
Polynuclear Aromatic Hydrocarbons			
Naphthalene	NA	0.02	U.S. EPA (2003a)
Acenaphthene	NA	0.06	U.S. EPA (2003a)
Fluorene	NA	0.04	U.S. EPA (2003a)
Anthracene	NA	0.3	U.S. EPA (2003a)
Fluoranthene	NA	0.04	U.S. EPA (2003a)
Pyrene	NA	0.02	U.S. EPA (2003a)
Benz[a]anthracene	1.2	NA	OEHHA (2001)
Chrysene	0.12	NA	OEHHA (2001)
Benzo[b]fluoranthene	1.2	NA	OEHHA (2001)
Benzo[k]fluoranthene	1.2	NA	OEHHA (2001)
Benzo[a]pyrene	12	NA	OEHHA (2001)
Indeno[1,2,3-cd]pyrene	1.2	NA	OEHHA (2001)
Dibenz[a,h]anthracene	4.1	NA	OEHHA (2001)
Polychlorinated Biphenyls			
Total PCBs[a]	2	NA	U.S. EPA (2003a)
Total PCBs (as Aroclor 1254)[b]	NA	0.00002	U.S. EPA (2003a)

28.2.3 Risk Characterization

For the Tier I screening level risk assessment, the Regional Board characterized potential risks of adverse effects to recreational and subsistence anglers by comparing *Macoma nasuta* tissue concentrations from the nine Shipyard Sediment Site stations to tissue screening values published by OEHHA and to those derived by the Regional Board. The tissue screening values are presented in Table 28-4 below. Site *Macoma* tissue pollutant concentrations greater than the screening values are considered to be a potential risk to recreational and/or subsistence anglers.

Table 28-4. Tissue Screening Values for Recreational and Subsistence Anglers

Chemical		Screening Values for Recreational Angler (µg/kg wet)	Screening Values for Subsistence Angler (µg/kg wet)
Metals	Arsenic, total (non-cancer)	1,000	**130**
	Arsenic, inorganic (cancer)	**22**	**0.29**
	Cadmium	3,000	**217**
	Chromium	**10,000**	**1,300**
	Copper	**120,000**	**16,000**
	Mercury, total	300	**44**
	Nickel	**67,000**	**9,000**
	Selenium	20,000	**2,000**
	Silver	**17,000**	**2,174**
	Zinc	**1,000,000**	**130,000**
Organometallic Compounds	Tributyltin	**1,000**	**130**
Polynuclear Aromatic Hydrocarbons	Naphthalene	**67,000**	**9,000**
	Acenaphthene	**200,000**	**26,000**
	Fluorene	**130,000**	**17,000**
	Anthracene	**1,000,000**	**130,000**
	Fluoranthene	**130,000**	**17,000**
	Pyrene	**67,000**	**9,000**
	Benz[a]anthracene	**28**	**0.36**
	Chrysene	**280**	**3.62**
	Benzo[b]fluoranthene	**28**	**0.36**
	Benzo[k]fluoranthene	**28**	**0.36**
	Benzo[a]pyrene	**2.8**	**0.04**
	Indeno[1,2,3-cd]pyrene	**28**	**0.36**
	Dibenz[a,h]anthracene	**8.1**	**0.11**
Polychlorinated Biphenyls	Total PCBs (cancer)	20	**0.22**
	Total PCBs (non-cancer)	**67**	**8.70**

Note: Screening values derived by the Regional Board are bold faced and shaded.

In addition to characterizing the risks at the Shipyard Sediment Site, the *Macoma* tissue concentrations at each site station were compared to the *Macoma* tissue concentrations derived from the reference pool described in Section 15 of this Technical Report. The objective of this comparison was to determine whether or not the current site conditions pose a greater risk to the recreational and subsistence anglers than the current reference conditions in San Diego Bay.

The reference pool *Macoma* tissue concentrations were calculated using the 95% upper prediction limit (UPL). The 95% UPL allows a one-to-one comparison to be performed between a single Shipyard Sediment Site station (i.e., each of the nine bioaccumulation site stations) and a pool of "Reference Condition" stations (i.e., Reference Pool). Although multiple comparisons were made to the reference pool prediction limits, the Regional Board made a decision to not correct for multiple comparisons so that the site/reference *Macoma* tissue comparisons would remain conservative and more protective. The upper 95% UPL for the reference pool *Macoma* tissue concentrations are provided in Table 28-5 below and the comparison results are provided in the Appendix for Section 28.

Table 28-5. Reference Pool Upper 95% Prediction Limits for *Macoma nasuta* Tissue Concentrations

***Macoma* Tissue Chemicals**	**95% Upper Prediction Limits**
Metals	
Arsenic	22.8 mg/kg
Cadmium	0.39 mg/kg
Chromium	3.9 mg/kg
Copper	19.2 mg/kg
Lead	3.3 mg/kg
Mercury	0.15 mg/kg
Nickel	4.4 mg/kg
Selenium	4.9 mg/kg
Silver	0.57 mg/kg
Zinc	85.7 mg/kg
Organometallic Compounds	
Tributyltin	12 μg/kg
Organics	
Benzo[a]pyrene	132 μg/kg
Total Polychlorinated Biphenyls (PCB), as congeners	186 μg/kg
Total Polychlorinated Terphenyls (PCT)	All Reference Pool stations undetected

28.2.4 Risk Management

The Regional Board identified two human health risk management decisions for the Tier I screening level risk assessment: (1) Current Shipyard Sediment Site conditions pose acceptable human health risks and no further action is warranted, and (2) Current site conditions pose a potential unacceptable human health risk that requires additional evaluation with a Tier II baseline risk assessment. These two management decisions are based on the human health risk characterization results at each site station and the *Macoma* tissue site/reference comparison results. A flow diagram showing how each management decision is triggered is shown below.

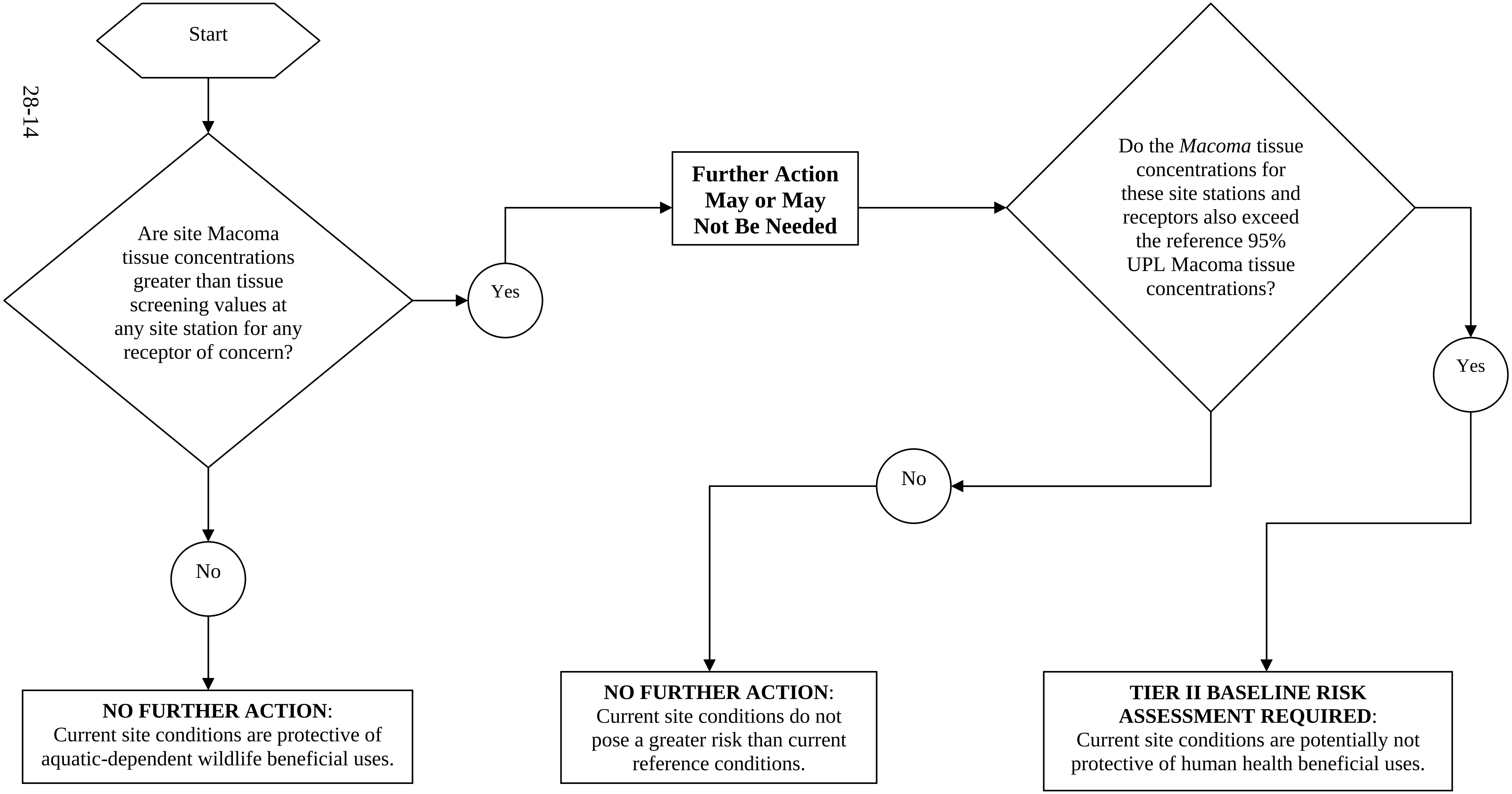

Figure 28-1. Flow Diagram for Tier I Human Health Risk Management Decisions

28.2.5 Uncertainties Related to Human Health Risk Estimates

The process of evaluating human health cancer and noncancer risks involves multiple steps. Inherent in each step of the risk assessment process are uncertainties that ultimately affect the risk estimates. Uncertainties may exist in numerous areas such as estimation of potential site exposures and derivation of toxicity values. The most significant uncertainties in the Tier I risk analysis for the Shipyard Sediment Site are discussed below.

Tissue Chemical Concentrations. For this assessment, a 28-day laboratory bioaccumulation test using the clam *Macoma nasuta* was used to estimate exposure of fish and shellfish to contaminants of concern present in site sediment. For PCBs, dioxins, furans, PAHs, and metals, 80% of steady state generally occurs using the 28-day bioaccumulation test (U.S. EPA, 1998a; ASTM, 2001). Bioaccumulation testing protocols recommend that the bioaccumulation contaminants of concern reach approximately 80% of steady state tissue residues for a proper risk assessment. Attaining 100% steady state is ideal but not required in Tier I because it is a screening-level risk assessment. The Regional Board recognizes that the observed tissue chemical concentrations in *Macoma nasuta* may be underestimated. Therefore, this may result in an underestimation of risk.

Surrogate for Fish and Shellfish. Chemical concentrations in *Macoma* tissue were used as a surrogate to estimate exposures to chemicals in seafood for recreational and subsistence anglers. While *Macoma* is not considered to be the primary seafood harvested from the Shipyard Sediment Site, use of *Macoma* tissue data for the Tier I risk analysis is a considered a conservative approach because *Macoma* are directly exposed to contaminants in the surface sediment. *Macoma* actively ingests surface sediment to feed on detritus and also burrows into the sediment. Therefore, use of *Macoma* tissue may result in an overestimation of risk.

Exposure Parameters. The exposure parameters selected for Tier I are considered to be conservative values and therefore may result in an overestimation of risk.

Multiple Comparisons. Because multiple comparisons were made to the Baseline Pool, and each comparison carries with it a low probability (5%) of falsely identifying a statistical difference, there is a significant potential for multiple comparison error (SCCWRP and U.S. Navy, 2005b). This may result in an overestimation of risk.

PCB Cancer Slope Factor. The PCB cancer slope factor (CSF) used in this assessment was based on the upper-bound slope estimates for Aroclors 1254 and 1260 (Exponent, 2003). Use of the upper-end CSFs (i.e., highest) is conservative and may overestimate risks from PCBs.

<u>Noncancer Risks from PCBs</u>. Aroclors 1260 and 1254 were the only two Aroclors detected in *Macoma nasuta* tissue at all site and reference stations. U.S. EPA has only published RfDs for Aroclor 1254 (0.00002 mg/kg-day) and Aroclor 1016 (0.00007 mg/kg-day). For this assessment, the more conservative RfD for Aroclor 1254 was used for Aroclor 1260. This may overestimate risks from PCBs.

<u>Inorganic Arsenic as a Percent of Total Arsenic</u>. In order to account for the percentage of arsenic in Macoma tissue that is nontoxic, concentrations of inorganic arsenic were assumed to be 4 percent of total arsenic. Use of this percentage is considered to be conservative because some studies have reported much smaller percentages (Exponent, 2003). Therefore, this may result in an overestimation of risk.

29. Finding 29: Tier II Baseline Comprehensive Risk Assessment for Human Health

The Tier II risk assessment objective was to more conclusively determine whether Shipyard Sediment Site conditions pose unacceptable cancer and non-cancer health risks to recreational and subsistence anglers posed an unacceptable human health risk. Fish and shellfish were collected within four assessment units at the Shipyard Sediment Site and from two reference areas located across the bay from the Shipyard Site. Chemical concentrations measured in fish fillets and edible shellfish tissue were used to estimate chemical exposure for recreational anglers and chemical concentrations in fish whole bodies and shellfish whole bodies were used to estimate chemical exposure for subsistence anglers. Based on the Tier II risk assessment results, ingestion of fish and shellfish caught within all four assessment units at the Shipyard Sediment Site poses a theoretical increased cancer and noncancer risk to recreational and subsistence anglers. The chemicals posing cancer risks include inorganic arsenic and PCBs. The chemicals posing noncancer risks include cadmium, copper, mercury, and total PCBs.

The Tier II human health risk assessment was based on tissue measurements from fish and shellfish collected from four discrete assessment units within and adjacent to the shipyard leaseholds: inside NASSCO, outside NASSCO, inside Southwest Marine, and outside Southwest Marine. Additionally, fish and shellfish were collected from a reference area located across the bay from the Shipyard Sediment Site. The fish and shellfish included spotted sand bass (*Paralabrax masculatofasciatus*) and spiny lobsters (*Panulirus interruptus*), respectively. While the Tier I screening level risk assessment identified only four chemicals as “possible” risks to the recreational and subsistence anglers (inorganic arsenic, benzo[a]pyrene, tributyltin, and PCBs), all chemicals of potential concern were analyzed in the Tier II human health risk assessment.[113] The Regional Board evaluated the Tier II risk assessment results and concluded that ingestion of spotted sand bass (whole body and fillet) and lobster (edible tissue only) caught within all four assessment units at the Shipyard Sediment Site poses a theoretical increased cancer risk, greater than one-in-a-million ($1x10^{-6}$) and greater than reference, to both the recreational and subsistence anglers. The primary contaminants contributing to the cumulative cancer risk include inorganic arsenic, benzo[a]pyrene, and total PCBs. Ingestion of spotted sand bass (whole body and fillet) and lobster (whole body and edible tissue) caught within all four assessment units at the Shipyard Sediment Site poses theoretical non-cancer risk, greater than the hazard index threshold of 1.0 and reference risk levels, to both the recreational and subsistence anglers. The primary contaminants

[113] Tier II risks were characterized by quantifying the cumulative cancer risks and cumulative non-cancer hazard index at each of the four assessment units described above and then comparing those risks to the cumulative cancer risks and cumulative non-cancer hazard index quantified at the reference area. An assessment unit was classified as a cancer risk to recreational or subsistence anglers when the cumulative risk exceeded both the target risk level of $1x10^{-6}$ and reference risk levels. An assessment unit was classified as a non-cancer risk to recreational or subsistence anglers when the cumulative hazard index exceeded both the hazard index threshold of 1.0 and reference risk levels.

~~contributing to the cumulative non-cancer risk include copper, total mercury, and total PCBs.~~

~~Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Cumulative Cancer Risk)~~

~~Assessment Unit~~		**~~Cumulative Cancer Risk~~**			**~~Primary Contaminant Drivers (% contribution to cumulative risk)~~**
		~~> 1x10^{-6}~~	**~~> Reference~~**	**~~Cancer Risk~~**	
~~Inside NASSCO Leasehold~~	~~Whole Body Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (97%)~~
	~~Fillet Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (38%)~~ ~~BAP (25%)~~
	~~Whole Body Lobster~~	~~Yes~~	~~No~~	~~No~~	~~Not applicable~~
	~~Edible Tissue Lobster~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Inorganic arsenic (84%)~~
~~Outside NASSCO Leasehold~~	~~Whole Body Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (88%)~~
	~~Fillet Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (42%)~~ ~~BAP (22%)~~
~~Inside Southwest Marine Leasehold~~	~~Whole Body Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (96%)~~
	~~Fillet Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (84%)~~
	~~Whole Body Lobster~~	~~Yes~~	~~No~~	~~No~~	~~Not applicable~~
	~~Edible Tissue Lobster~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Inorganic arsenic (63%)~~ ~~PCBs (20%)~~
~~Outside Southwest Marine Leasehold~~	~~Whole Body Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (93%)~~
	~~Fillet Sand Bass~~	~~Yes~~	~~Yes~~	~~Yes~~	~~PCBs (62%)~~ ~~BAP (17%)~~

Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Cumulative Non-Cancer Risk)

Assessment Unit		Cumulative Non-Cancer Risk			Primary Contaminant Drivers (% contribution to cumulative risk)
		> 1	> Reference	Non-Cancer Risk	
Inside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (98%)
	Fillet Sand Bass	Yes	No	No	Not applicable
	Whole Body Lobster	Yes	Yes	Yes	PCBs (55%) Copper (26%)
	Edible Tissue Lobster	Yes	Yes	Yes	Total Mercury (75%)
Outside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (92%)
	Fillet Sand Bass	Yes	No	No	Not applicable
Inside Southwest Marine Leashold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (97%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (89%)
	Whole Body Lobster	Yes	Yes	Yes	PCBs (52%) Copper (27%)
	Edible Tissue Lobster	Yes	Yes	Yes	PCBs (64%) Total mercury (22%)
Outside Southwest Marine Leashold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (96%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (73%) Total mercury (25%)

29.1 Tier II Results

For the Tier II risk assessment, recreational anglers and subsistence anglers were identified as potential human receptors that could be at risk due to exposure to chemical pollutants in fish and shellfish caught at the Shipyard Sediment Site. Chemical pollutant concentrations measured in spotted sand bass and lobster tissues were used to assess the potential risks. Although the Tier I screening level risk assessment identified only four chemical pollutants as "possible" risks to recreational and subsistence anglers, all chemical pollutants of potential concern were analyzed in the spotted sand bass and lobster tissues and evaluated in the Tier II risk assessment.

Based on the Tier II results as summarized in Tables 29-1 and 29-2 below, the Regional Board determined that human ingestion of seafood caught within all four assessment units at the Shipyard Sediment Site poses a cancer risk greater than $1x10^{-6}$ and non-cancer risk greater than 1 to both recreational and subsistence anglers. Additionally, the Shipyard Sediment Site poses a greater cancer and non-cancer risk to recreational and subsistence anglers than the risks posed at reference conditions in San Diego Bay. The carcinogenic chemicals of concern include inorganic arsenic and total polychlorinated biphenyls (PCBs). The non-carcinogenic chemicals of concern include cadmium, copper, mercury, and total PCBs. The Tier II risk calculations and results are provided in the Appendix for Section 29.

Table 29-1. Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Cancer Risk)

Assessment Unit	Receptor	Diet	Carcinogenic Chemicals of Concern	Cancer Risk		
				> $1x10^{-6}$	> Reference	Risk [1]
Inside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	No	No
			PCBs	Yes	No	No
		Edible Lobster Tissue	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	No	No
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
		Whole Body Lobster	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
Outside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
Inside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
		Edible Lobster Tissue	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
		Whole Body Lobster	Inorganic Arsenic	Yes	No	No
			PCBs	Yes	Yes	**Yes**
Outside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**

[1] A cancer risk exists when the site risk is greater than 1x10-6 and greater than the risk calculated for the reference area.

Table 29-2. Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Non-Cancer Risk)

Assessment Unit	Receptor	Diet	Non-carcinogenic Chemicals of Concern	Non-cancer Risk		
				> 1	> Reference	Risk [1]
Inside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	No	No	No
		Edible Lobster Tissue	Mercury	Yes	Yes	**Yes**
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
		Whole Body Lobster	Cadmium	No	No	No
			Copper	Yes	Yes	**Yes**
			Mercury	Yes	No	No
			PCBs	Yes	Yes	**Yes**
Outside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	No	Yes	No
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
Inside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	Yes	Yes	**Yes**
		Edible Lobster Tissue	Mercury	No	No	No
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**
		Whole Body Lobster	Cadmium	Yes	Yes	**Yes**
			Copper	Yes	No	No
			Mercury	Yes	No	No
			PCBs	Yes	Yes	**Yes**
Outside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	Yes	Yes	**Yes**
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	Yes	**Yes**
			PCBs	Yes	Yes	**Yes**

[1] A non-cancer risk exists when the site hazard index is greater than 1.0 and greater than the hazard index calculated for the reference area.

29.2 Tier II Approach

The Regional Board conducted a Tier II human health risk assessment (i.e., baseline risk assessment) to more conclusively determine whether or not the current conditions at the Shipyard Sediment Site pose unacceptable risks to human health and to identify the need for remedial action. Risks were characterized by: (1) quantifying the cancer and non-cancer risks at the site, and (2) comparing the site risks to the risks calculated for the reference areas.

The baseline risk assessment was conducted in accordance with U.S. EPA's "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)" (U.S. EPA, 1989b) and in consultation with California Office of Environmental Health Hazard (OEHHA). The approach consists of the following key elements:

- Identification of Chemicals of Potential Concern;
- Exposure Assessment;
- Toxicity Assessment;
- Risk Characterization;
- Risk Management; and
- Uncertainties Related to Risk Estimates.

These key elements are discussed in more detail below.

29.2.1 Identification of Chemicals of Potential Concern

Chemical pollutant concentrations in fish and shellfish caught at the Shipyard Sediment Site were compared with tissue screening concentrations to identify chemical pollutants of potential concern that require further evaluation in the baseline risk assessment. Tissue screening concentrations were developed for carcinogenic and non-carcinogenic chemical pollutants using the same equations as those used in the California Lakes Study by the Office of Environmental Health Hazard Assessment (Brodberg and Pollock, 1999). For carcinogenic chemicals, screening concentrations were derived as follows (Exponent, 2003):

$$\mathbf{TRG = (TRL \times BW) / (CSF \times CR \times FI \times ABS)}$$

where:

TRG	=	Tissue screening level for fish and/or shellfish tissue (µg/kg)
TRL	=	Target risk level (unit-less)
BW	=	Body weight (kg)
CSF	=	Carcinogenic slope factor $(mg/kg\text{-}day)^{-1}$
CR	=	Fish and shellfish consumption rate (kg/day)
FI	=	Fractional intake of seafood consumed that originates from site (unit-less)
ABS	=	Fraction absorbed (unit-less)

For non-carcinogenic chemicals, screening concentrations were derived as follows (Exponent, 2003):

$$\textbf{TRG = (RfD x BW) / (CR x FI)}$$

where:

TRG	=	Tissue screening level for fish and/or shellfish tissue (µg/kg)
RfD	=	Reference dose (mg/kg-day)
BW	=	Body weight (kg)
CR	=	Fish and shellfish consumption rate (kg/day)
FI	=	Fractional intake of seafood consumed that originates from site (unit-less)

As discussed in Section 29.2.2 below, the receptors of concern identified for the baseline risk assessment are recreational anglers and subsistence anglers. Separate screening concentrations were developed for these two anglers using highly conservative assumptions. The assumptions used to derive screening concentrations for carcinogenic and non-carcinogenic chemicals are shown below in Tables 29-3 and 29-4.

Table 29-3. Assumptions Used to Derive Tissue Screening Concentrations for Carcinogenic Chemicals

Parameter		Units	Recreational Angler	Subsistence Angler
Target risk level	TRL	none	1×10^{-6}	1×10^{-6}
Body Weight	BW	kg	70	70
Carcinogenic slope factor	CSF	$(mg/kg\text{-}day)^{-1}$	See Toxicity Assessment Section Below	See Toxicity Assessment Section Below
Fish or shellfish consumption rate	CR	kg/day	0.021[a]	0.161[b]
Fractional intake of seafood consumed from site	FI	none	1	1
Fraction absorbed	ABS	none	1	1

[a] OEHHA, 2001
[b] SCCWRP and MBC, 1994

Table 29-4. Assumptions Used to Derive Tissue Screening Concentrations for Non-Carcinogenic Chemicals

Parameter		Units	Recreational Angler	Subsistence Angler
Reference dose	RfD	(mg/kg-day)	See Toxicity Assessment Section Below	See Toxicity Assessment Section Below
Body Weight	BW	kg	70	70
Fish or shellfish consumption rate	CR	kg/day	0.021[a]	0.161[b]
Fractional intake of seafood consumed from site	FI	none	1	1

[a] OEHHA, 2001
[b] SCCWRP and MBC, 1994

As a further conservative assumption, the maximum chemical pollutant concentrations in fish (spotted sand bass) and shellfish (spiny lobsters) caught from the Shipyard Sediment Site were compared to the tissue screening concentrations. Maximum chemical pollutant concentrations in fillets of spotted sand bass and in edible tissue portions of spiny lobsters were used to identify chemicals of concern for the recreational angler. Chemical pollutant concentrations in whole bodies of spotted sand bass and in whole bodies of spiny lobsters were used to identify chemicals of concern for the subsistence angler. The comparisons are shown below in Tables 29-5 and 29-6.

Table 29-5. Screening of Chemicals of Potential Concern in Fish and Lobster Tissue for Recreational Angler

Chemical	Maximum Fillet Spotted Sand Bass Concentration (μg/kg)	Maximum Edible Tissue Lobster Concentration (μg/kg)	Human Health Tissue Screening Concentration (μg/kg)
Metals			
Arsenic, inorganic (non-carcinogenic)	28	532	1,000
Arsenic , inorganic (carcinogenic)	**28**	**532**	2.2
Cadmium	2.5 U	50	1,667
Chromium	50 U	50 U	10,000
Copper	460	17,900	123,333
Mercury, total	224	**521**	333
Nickel	20 U	50 U	66,667
Selenium	500	300	16,667
Silver	2 U	21	16,667
Zinc	4,900	32,400	1,000,000
Organometallic Compounds			
Tributyltin	23	9.6	1,000
Polycyclic Aromatic Hydrocarbons			
Naphthalene	5 U	5 U	66,667
Acenaphthene	5 U	5 U	200,000
Fluorene	5 U	5 U	133,333
Anthracene	5 U	5 U	1,000,000
Fluoranthene	5 U	5 U	133,333
Pyrene	5 U	5 U	66,667
Benz[a]anthracene	5 U	5 U	2.8
Chyrysene	5 U	5 U	28
Benzo[b]fluoranthene	5 U	5 U	2.8
Benzo[k]fluoranthene	5 U	5 U	2.8
Benzo[a]pyrene	5 U	5 U	0.3
Indeno[1,2,3-cd]pyrene	5 U	5 U	2.8
Dibenz[a,h]anthracene	5 U	5 U	0.8
Polychlorinated Biphenyls			
Total PCB Aroclors (carcinogenic)	**400**	**21**	1.7
Total PCB Aroclors (noncarcinogenic)	**400**	21	67

Notes: Chemical concentrations exceeding a tissue screening concentration are bold faced and shaded.
Inorganic arsenic concentration was estimated assuming that 4 percent of total arsenic was inorganic.
Chemicals not detected in any sample from a station are qualified with a "U" and one-half the quantitation limit is listed.

Table 29-6. Screening of Chemicals of Potential Concern in Fish and Lobster Tissue for Subsistence Angler

Chemical	Maximum Whole Body Spotted Sand Bass Concentration (µg/kg)	Maximum Whole Body Lobster Concentration (µg/kg)	Human Health Tissue Screening Concentration (µg/kg)
Metals			
Arsenic, inorganic (non-carcinogenic)	36	**260**	130
Arsenic, inorganic (carcinogenic)	**36**	**260**	0.3
Cadmium	40	**230**	217
Chromium	700	200 U	1,304
Copper	6,100	**67,000**	16,087
Mercury, total	**200**	**59**	43
Nickel	440	110	8,696
Selenium	1,000	400	2,174
Silver	41	260	2,174
Zinc	22,000	28,000	130,435
Organometallic Compounds			
Tributyltin	63	27	130
Polycyclic Aromatic Hydrocarbons			
Naphthalene	10 U	10 U	8,696
Acenaphthene	10 U	10 U	26,087
Fluorene	10 U	16	17,391
Anthracene	10 U	18	130,435
Fluoranthene	10 U	13	17,391
Pyrene	10 U	10 U	8,696
Benz[a]anthracene	10 U	10 U	0.4
Chyrysene	10 U	10 U	3.6
Benzo[b]fluoranthene	10 U	10 U	0.4
Benzo[k]fluoranthene	10 U	10 U	0.4
Benzo[a]pyrene	10 U	10 U	0.04
Indeno[1,2,3-cd]pyrene	10 U	10 U	0.4
Dibenz[a,h]anthracene	10 U	10 U	0.1
Polychlorinated Biphenyls			
Total PCB Aroclors (carcinogenic)	**2,100**	**76**	0.2
Total PCB Aroclors (noncarcinogenic)	**2,100**	**76**	8.7

Notes: Chemical concentrations exceeding a tissue screening concentration are bold faced and shaded.
Inorganic arsenic concentration was estimated assuming that 4 percent of total arsenic was inorganic.
Chemicals not detected in any sample from a station are qualified with a "U" and one-half the quantitation limit is listed

The following chemical pollutants exceeded their respective tissue screening concentrations for the recreational angler and were further evaluated in the baseline risk assessment:

- **Fish Fillet -** Inorganic arsenic (carcinogenic) and PCBs (carcinogenic and non-carcinogenic); and
- **Edible Lobster Tissue** - Inorganic arsenic (carcinogenic), mercury, and PCBs (carcinogenic).

The following chemical pollutants exceeded their respective tissue screening concentrations for the subsistence angler and were further evaluated in the baseline risk assessment:

- **Whole Body Fish -** Inorganic arsenic (carcinogenic), mercury, and PCBs (carcinogenic and non-carcinogenic); and
- **Whole Body Lobster -** Inorganic arsenic (carcinogenic and non-carcinogenic), cadmium, copper, mercury, and PCBs (carcinogenic and non-carcinogenic).

29.2.2 Exposure Assessment

The objective of the exposure assessment is to evaluate the type and magnitude of human exposures to chemicals of concern that are present at or migrating from the Shipyard Sediment Site (U.S. EPA, 1989b). Human exposure to contaminated marine sediment can occur around the following three principal pathways:

- Direct contact of contaminated marine sediment by swimmers or divers;
- Incidental ingestion of contaminated marine sediment or associated waters by swimmers or divers; and
- Bioaccumulation and food chain transfer of sediment pollutants to human consumers of contaminated fish and shellfish.

The most significant theoretical human health risk associated with contaminated marine sediment is considered to be the ingestion, over time, of fish and shellfish that may have bioaccumulated chemical pollutants either directly from marine sediment or through the food web (Long, 1989). U.S. EPA literature suggests that even when conservative assumptions about direct human exposure are used, risks associated with dermal contact and incidental ingestion of contaminated sediment are minimal and contribute less to the total risk than the fish and shellfish consumption pathway. The human health risks associated with fish and shellfish consumption often constitute the greatest proportion of the total risk, and sometimes drive the human health risk assessment. (U.S. EPA, 1992b)

29.2.2.1 Shipyard Sediment Site Exposure Assessment

The most significant potential source of human exposure to pollutants at the Shipyard Sediment Site is through consumption of fish and shellfish that may have bioaccumulated chemicals either directly from site sediment or through the food web (Exponent, 2003). Direct contact with sediment pollutants at the Shipyard Sediment Site is not a likely exposure pathway to humans because the industrial nature of the site and the lack of a beach (shoreline at Shipyard Sediment Site consists almost exclusively of riprap, sheet-pile bulkhead, and piers) make swimming and wading a highly unlikely event. Therefore, two types of receptors (i.e., members of the population or individuals at risk) were identified and further evaluated in the baseline risk assessment. The two receptor types are as follows:

- **Recreational Angler** - represents those who eat the fish and/or shellfish they catch recreationally; and
- **Subsistence Angler** - represents those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet.

Exponent reported that public fishing and shellfish harvesting are currently unlikely events at the Shipyard Sediment Site due to the current security measures. Under the current site usage, there are security measures in place at both the upland property and the in-water leaseholds of NASSCO and BAE Systems due to the work performed on Navy ships (Exponent, 2003). Force protection measures are required for Navy vessels and prohibit non-mission-essential vessels from approaching Navy ships. A security boom prevents unauthorized vessels from approaching closer than 300 feet in the NASSCO and BAE Systems leaseholds. Furthermore, armed personnel are present at all times to ensure that no trespassing occurs at the site.

Despite these factors the Regional Board required a baseline risk assessment using the two receptors identified above based on the following considerations (Brodberg, 2004):

- NASSCO and BAE Systems employees or Navy personnel may fish off of the piers, bulkhead, riprap, ships, etc.;
- NASSCO and BAE Systems may not occupy the site in the future and future site usage may allow for fishing. This scenario recently occurred at a former shipyard (Campbell Shipyard) located in San Diego Bay just north of NASSCO and BAE Systems;
- Contaminants within the NASSCO and BAE Systems leaseholds may have migrated to areas outside the leasehold where fishing by boat and fishing at a nearby public pier (Crosby Street Park Pier located approximately ½ mile north of BAE Systems just past the Coronado Bridge) is accessible; and

- The Regional Board's statutory responsibility is to protect the beneficial uses designated for San Diego Bay. The beneficial uses pertaining to human health are Commercial and Sport Fishing (COMM) and Shellfish Harvesting (SHELL). COMM and SHELL are to be protected at all times regardless of the current site-access measures that prevent the uses from occurring.

To focus the baseline risk assessment, the Shipyard Sediment Site was divided into the following four discrete assessment units (Exponent, 2003):

- **Inside NASSCO –** the area inside the NASSCO leasehold;
- **Outside NASSCO –** the area between the NASSCO leasehold and the shipping channel;
- **Inside BAE Systems –** the area inside the BAE Systems leasehold; and
- **Outside BAE Systems –** the area between the BAE Systems leasehold and the shipping channel.

This was done for the following reasons: (1) chemical pollutant concentrations in sediment vary at the NASSCO and BAE Systems leasehold portion of the Shipyard Sediment Site due to the differences in historical activities/operations conducted at the two shipyards, (2) access restrictions differ inside versus outside the leaseholds, (3) the types of fishing that could occur from piers/shoreline are different from those via boat access, and (4) the relative size of the four assessment units will affect the amount of fish and shellfish that could potentially be consumed from each unit. Therefore, risks to the recreational and subsistence anglers were evaluated separately in each of the four assessment units to identify areas with greater likelihood for adverse health effects.

Separate chemical pollutant exposure estimates were developed for each angler in each of the four assessment units using tissue concentrations from the following two types of fish and shellfish caught at the Shipyard Sediment Site:

- **Spotted Sand Bass (*Paralabrax masculatofasciatus*) –** Chemical concentrations in sand bass fillets and whole bodies were used to estimate exposure to chemicals in food for the recreational angler and subsistence angler, respectively; and
- **Spiny Lobsters (*Panulirus interruptusi*) –** Chemical concentrations in edible tissue (all soft tissue, including hepatopancreas) and the entire organism, including the shell, were used to estimate exposure to chemicals in food for the recreational angler and subsistence angler, respectively.

Human exposure to contaminants in fish and shellfish collected at the Shipyard Sediment Site was estimated using the following simple exposure model consistent with U.S. EPA (1998b) guidance (Exponent, 2003):

Intake (mg/kg-day) = (C x CR x FI x ED x EF) / (BW x AT x CF)

where:

C	=	Tissue chemical concentration in spotted sand bass and spiny lobster (µg/kg-wet weight)
CR	=	Fish consumption rate (kg/day)
FI	=	Fraction ingested from the site (unitless)
ED	=	Exposure duration (years)
EF	=	Exposure frequency (days/year)
BW	=	Body weight (kg)
AT	=	Averaging time (days) - non-carcinogens: exposure duration x 365 days - carcinogens: 70-year lifetime x 365 days
CF	=	Conversion factor (1,000 µg/mg)

According to U.S. EPA guidance, exposures should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site. The assumptions used by the Regional Board to estimate the RME at the Shipyard Sediment Site are shown below in Table 29-7 and the exposure estimate calculations using these assumptions are provided in the Appendix for Section 29.

Table 29-7. Reasonable Maximum Exposure Assumptions for Recreational and Subsistence Anglers

Parameter		Units	Recreational Angler	Subsistence Angler
Tissue Chemical Concentration	C	ug/kg-wet wt	Maximum	Maximum
Fish or Shellfish Consumption Rate	CR	kg/day	0.021[a]	0.161[b]
Body Weight	BW	kg	70	70
Exposure Duration	ED	years	30	30
Exposure Frequency	EF	days/year	365	365
Fraction Ingested from Site or Reference	FI	unitless	1	1
Averaging Time for Carcinogens	AT_c	days	25,550	25,550
Averaging Time for Noncarcinogens	AT_n	days	10,950	10,950
Conversion Factor	CF	µg/mg	1,000	1,000

[a] OEHHA 2001
[b] SCCWRP and MBC 1994

29.2.3 Toxicity Assessment

The toxicity assessment identifies toxicity values for each chemical pollutant of concern and discusses their potential adverse effects to humans (U.S. EPA, 1989b). Two types of toxicity values are evaluated: cancer slope factors (CSFs) for carcinogenic chemicals and reference doses (RfDs) for non-carcinogenic chemicals.

CSFs and RfDs from U.S. EPA's Integrated Risk Information System (IRIS) were used in the baseline risk assessment (U.S. EPA, 2003a). The CSFs and RfDs for the chemicals of concern identified in Section 29.2.1 are listed in Table 29-8 below.

Table 29-8. Cancer Slope Factors and Reference Doses for Chemicals of Concern

Chemical	CSF (mg/kg-day)$^{-1}$	RfD (mg/kg-day)	Source
Metals			
Arsenic, inorganic	1.5	0.0003	U.S. EPA (2003a)
Cadmium	NA	0.0005	U.S. EPA (2003a)
Copper	NA	0.037	U.S. EPA (2003a)
Mercury, total	NA	0.0001	U.S. EPA (2003a)
Polychlorinated Biphenyls			
Total PCBs	2	NA	U.S. EPA (2003a)
Total PCBs (as Aroclor 1254)	NA	0.00002	U.S. EPA (2003a)

29.2.4 Risk Characterization

Risk characterization is the final step of the baseline risk assessment process, which combines the information from the exposure assessment and toxicity assessment to yield estimated cancer risks and non-cancer health hazards from exposure to the chemicals of concern (U.S. EPA, 1989b).

For the baseline risk assessment, the Regional Board characterized potential health risks to the recreational and subsistence anglers by quantifying the cancer and non-cancer risks at each of the four assessment units. Risks from exposure to the carcinogenic chemicals of concern were estimated using the following equation:

$$\textbf{Risk = (Intake x CSF)}$$

where:

Intake = Human exposure to chemical concentrations in fish and shellfish tissue (mg/kg-day)
CSF = Cancer slope factor (mg/kg-day)$^{-1}$

The Regional Board selected a target cancer risk level of $1x10^{-6}$ (one-in-a-million) to be consistent with federal and state water quality criterion that protects human health. The 10^{-6} cancer risk level has historically formed the basis of human health protective numerical water quality objectives in California (RWQCB, 2003a). It is generally recognized by California and U.S. EPA as the *de minimis* or negligible level of risk associated with involuntary exposure to toxic chemicals in environmental media. The 10^{-6} risk level used in water-related health-protective regulatory decision-making in California include the following:

- Clean Water Act water quality criteria promulgated for California waters by U.S. EPA in the National Toxics Rule and the California Toxics Rule state that "[t]he human health criteria shall be applied at the State-adopted 10^{-6} risk level." These criteria, when combined with beneficial use designations in state *Water Quality Control Plans* (SWRCB, 1997) are water quality standards for California's inland and estuarine surface waters.
- *Functional Equivalent Documents* adopted by the State Water Resources Control Board that provide background and justification for the *California Ocean Plan* (SWRCB, 2001) and the former *California Inland Surface Waters* and *Enclosed Bays and Estuaries Plans* (SWRCB, 2000) cite the 10^{-6} risk level as the basis for human health protective water quality objectives for carcinogens.

Risks from exposure to non-carcinogenic chemicals of concern were estimated using the following equation:

Hazard Index = (Intake / RfD)

where:

Intake	=	Human exposure to chemical concentrations in fish and shellfish tissue (mg/kg-day)
RfD	=	Reference dose (mg/kg-day)

A hazard index less than 1.0 indicates that human exposure to chemical pollutant concentrations in fish and shellfish is below the level that is expected to result in a significant health risk. A hazard index greater than 1.0 indicates unacceptable exposures may be occurring, and there may be an increased concern for potential non-cancer effects (TAMS/Gradient Corporation, 2000). However, the relative values of a hazard index greater than 1.0 cannot be used to describe the severity of the risk. The cancer and non-cancer risk calculations for the recreational and subsistence angler at each assessment unit are provided in the Appendix for Section 29.

In addition to characterizing the risks at the Shipyard Sediment Site, risks were also characterized at two reference areas to determine whether or not the site poses a greater risk to recreational and subsistence anglers than reference conditions in San Diego Bay. The two reference areas are located across the bay from the Shipyard Sediment Site (Exponent, 2003). Spotted sand bass were collected from a reference area located in the vicinity of Reference Station 2240 and the chemical concentrations in fillets and whole bodies were used to estimate exposure to recreational and subsistence anglers, respectively. Spiny lobsters were collected from a reference area located in the vicinity of Reference Station 2230 and the chemical concentrations in edible tissue and the entire organism were used to estimate exposure to recreational and subsistence anglers, respectively. Carcinogenic and non-carcinogenic risks at the reference areas were calculated using the same chemical pollutant of concern, exposure assumptions, toxicity values, and risk equations as those identified above for the Shipyard Sediment Site. The calculations and risk characterization results for the two reference areas are provided in the Appendix for Section 29.

29.2.5 Risk Management

The Regional Board identified two risk management decisions: (1) Current site conditions pose acceptable cancer and non-cancer risks and no further action is warranted, and (2) Current site conditions pose unacceptable cancer and/or non-cancer risks and remedial action is required. These two management decisions are based on the risk characterization results at the Shipyard Sediment Site and at the reference locations. A flow diagram showing how each management decision is triggered is shown below.

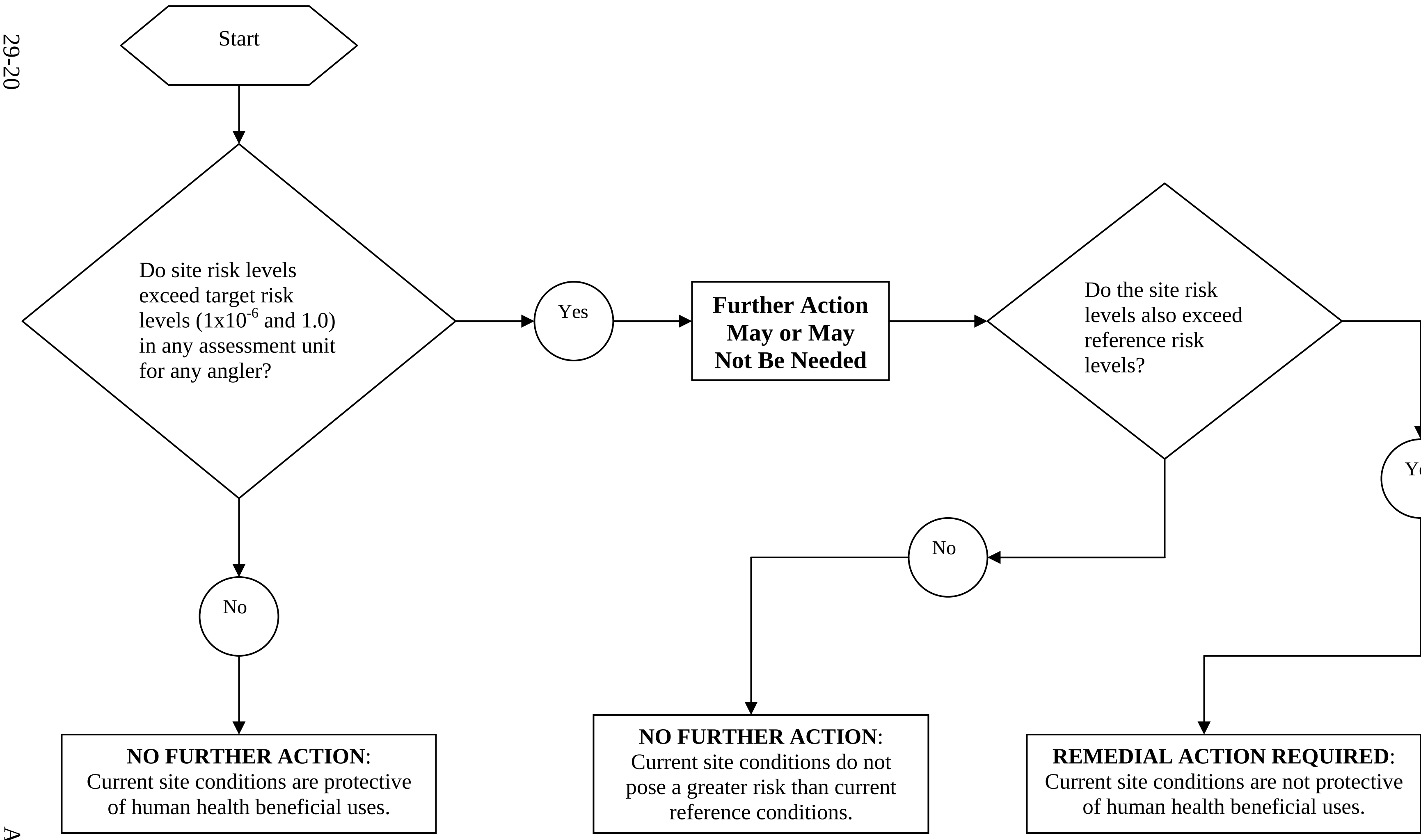

Figure 29-1. Flow Diagram for Human Health Risk Management Decisions

29.2.6 Uncertainties Related to Risk Estimates

The process of evaluating human health cancer risk and non-cancer hazard indices involves multiple steps. Inherent in each step of the risk assessment process are uncertainties that ultimately affect the risk estimates. Uncertainties may exist in numerous areas such as estimation of potential site exposures and derivation of toxicity values. The most significant uncertainties in the Tier II risk analysis for the Shipyard Sediment Site are discussed below.

Fractional Intake. Exponent (2003) used the following fractional intake assumptions for the human health risk assessment: Inside NASSCO = 0.034 (or 3.4 %), Outside NASSCO = 0.005 (or 0.5%), Inside BAE Systems = 0.023 (or 2.3%), and Outside BAE Systems = 0.002 (or 0.2%). In contrast, the Regional Board used a fractional intake of 1 based on the assumption that 100% of the fish and shellfish caught and consumed by recreational and subsistence anglers is from the Shipyard Sediment Site. While it is possible that these anglers could catch their seafood from other locations in San Diego Bay, thus reducing their site fractional intake, the Regional Board considers anything less than 100% as not providing full protection of San Diego Bay beneficial uses.

The objective of the human health risk assessment is to determine whether or not the Commercial and Sport Fishing (COMM) and Shellfish Harvesting (SHELL) beneficial uses at the Shipyard Sediment Site are impaired. Protection of COMM and SHELL is interpreted to mean that the fish and shellfish at the Shipyard Sediment Site should be safe to eat at typical consumption rates for both recreational and subsistence anglers. COMM and SHELL would not be considered fully protected if a person is limited to only consuming fish and shellfish from a site a fraction of the time (e.g., only 0.5 percent of the time). Furthermore, it is not unreasonable to assume that an angler, perhaps one who lives in the immediate vicinity of the Shipyard Sediment Site, would return to the same spot day after day to catch fish for consumption. For example, in the future the shipyard property may be available for recreational use and a public pier erected. It would not be unusual for an angler to do most or all of their fishing from one particular pier, especially if it is convenient to their residence. It is the Regional Board's statutory responsibility to protect for COMM and SHELL beneficial uses as the Water Board's mission statement states "… for the benefit of present and future generations." A fractional intake of 100% is considered to be conservative and yet reasonably protective of the human health category of beneficial uses.

Exposure Concentration. U.S. EPA guidance recommends that the tissue chemical concentrations used in the intake equation be either the 95 percent upper confidence limit (UCL) on the arithmetic average concentration or the maximum concentration, whichever is lesser (U.S. EPA, 1989b). In order to simplify the risk calculations, the Regional Board only used the maximum concentration observed in spotted sand bass (fillet and whole body) and lobster (edible tissue and whole body) to estimate risks at each of the four assessment units and at the two reference areas. This may result in an under- or overestimation of risks at the Shipyard Sediment Site.

<u>Spotted Sand Bass Home Range</u>. Spotted sand bass were collected in four discrete assessment units at the Shipyard Sediment Site: inside NASSCO leasehold, outside NASSCO leasehold, inside BAE Systems leasehold, and outside BAE Systems leasehold. It is assumed that the assessment units bound the home range for these spotted sand bass and that the observed tissue chemical concentrations are based exclusively from exposure within these areas. This may, however, not be indicative of their actual exposures because these fish may feed beyond the assessment unit boundaries. Therefore, the estimated risk to the recreational and subsistence anglers ingesting the fish is considered conservative and does not characterize actual exposures to the Shipyard Sediment Site.

<u>PCB Cooking Losses</u>. Numerous studies have evaluated the loss of PCBs from fish during preparation and cooking (Exponent, 2003). Reductions of PCBs ranged from 26 to 90 percent using cooking methods such as microwaving, boiling, and frying. For this assessment, a 50 percent reduction factor for PCBs in spotted sand bass fillets was used to assess potential risks to recreational anglers (Brodberg, 2004). A PCB cooking loss factor was not applied to spotted sand bass whole bodies because of the various preparation and cooking methods (such as boiling the entire fish to make a soup) and other related habits (such as consuming pan drippings from frying) potentially used by subsistence anglers. These cooking loss factor assumptions may underestimate or overestimate PCB cancer risks and PCB non-cancer hazards.

<u>PCB Cancer Slope Factor</u>. The PCB cancer slope factor (CSF) used in this assessment was based on the upper-bound slope estimates for Aroclors 1254 and 1260 (Exponent, 2003). Use of the upper-end CSFs (i.e., highest) is conservative and may overestimate risks from PCBs.

<u>Noncancer Risks from PCBs</u>. Aroclors 1260 and 1254 were the only two Aroclors detected in spotted sand bass and lobster caught at the Shipyard Sediment Site. Aroclor 1260 was detected in spotted sand bass (whole body and fillet) and lobster (whole body and edible tissue). Aroclor 1254 was detected in spotted sand bass (whole body and fillet). U.S. EPA has only published RfDs for Aroclor 1254 (0.00002 mg/kg-day) and Aroclor 1016 (0.00007 mg/kg-day). For this assessment, the more conservative RfD, Aroclor 1254, was used as a surrogate for Aroclor 1260. This may overestimate risks from PCBs.

<u>Inorganic Arsenic as a Percent of Total Arsenic</u>. In order to account for the percentage of arsenic in fish tissue that is nontoxic, concentrations of inorganic arsenic were assumed to be 4 percent of total arsenic (Exponent, 2003). Use of this percentage is considered to be conservative because some studies have reported much smaller percentages. Therefore, this may result in an overestimation of risk.

29.3 Comparison to Fish Advisories

The U.S. EPA and U.S. Department of Health and Human Services issued an advisory in 2004 for safe consumption of fish (U.S. EPA, 2004a[114]). The 2004 U.S. EPA advisory, recognizing that fish and shellfish are a part of a healthy diet, as well as recognizing that nearly all fish and shellfish contain some amounts of mercury, recommends that women[115] and young children limit their exposure to the harmful effects of mercury by limiting fish consumption

The 2004 U.S. EPA advisory recommends that people avoid eating fish and shellfish with the highest levels of mercury. For example, king mackerel is on the U.S. EPA list of fish with the highest levels of mercury with an average concentration of 0.73 mg/kg[116]. Fish listed as having lower levels of mercury include fresh salmon (0.01 mg/kg), Pacific mackerel (0.09 mg/kg), and light canned tuna (0.12 mg/kg). For comparison, the average mercury concentrations of the fish, both fillets and whole body, from the four shipyard areas and the reference areas ranged from 0.12 to 0.19 mg/kg (Table 29-9).

The 2004 U.S. EPA advisory recommends that "…women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury… [if they] …eat up to 12 ounces a week of a variety of fish and shellfish that are lower in mercury." For comparison, the consumption rates used in this Technical Report and the Shipyard Report are approximately 5.2 ounces per week (21 g/day) and 39.8 ounces per week (161 g/day) for the recreational and subsistence anglers, respectively. Therefore, assuming that the Shipyard Sediment Site fish fall within the U.S. EPA definition of fish lower in mercury, the subsistence angler consumption rate is over three times the recommended levels for women and young children.

A 2004 U.S. EPA Technical Memorandum provides details on the origin of a national advisory for fish consumption based on mercury exposure (U.S. EPA, 2004b). For fish with mercury concentrations in the range of those reported for the shipyards and reference areas (i.e. 0.12 to 0.23 mg/kg), they advise no more than 6 ounces per week. For comparison, the consumption rates used in this Technical Report and the Shipyard Report are approximately 5.2 ounces per week (21 g/day) and 39.8 ounces per week (171 g/day) for the recreational and subsistence anglers, respectively. Therefore, the recreational angler consumption rate is within the recommendation, but the subsistence angler consumption rate is over six times the recommended levels.

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[114] http://www.cfsan.fda.gov/~dms/admehg3.html

[115] Women who might become pregnant, women who are pregnant, nursing mothers, and young children.

[116] http://www.cfsan.fda.gov/~frf/sea-mehg.html

Regarding exposure to PCBs from fish consumption, the California Office of Environmental Health Hazard Assessment (OEHHA) website[117] states "In certain areas in California, PCBs have been measured in sport-caught fish at levels well above 100 ppb. These elevated levels may pose a health concern. OEHHA advises you to limit how much you eat of fish taken in these locations" (OEHHA, 2005). As indicated on Table 29-9 all four of the shipyard areas reported mean whole body concentrations above 100 ppb[118] and one of the areas reported mean fillet concentrations above 100 ppb with two others very close to 100 ppb.

Table 29-9. Spotted Sand Bass Data – Mean Concentration (Wet Weight)

	Reference	Inside NASSCO	Outside NASSCO	Inside BAE Systems	Outside BAE Systems
Fillet Data					
Mercury (total, mg/kg)	0.19	0.12	0.15	0.18	0.16
PCB Congeners (µg/kg)	67.4	44.4	99.4	193	99.8
Whole Body Data					
Mercury (total, mg/kg)	0.12	0.16	0.15	0.13	0.14
PCB Congeners (µg/kg)	490	760	544	430	544

(Exponent, 2003)

[117] http://www.oehha.ca.gov/fish/pcb/index.html

[118] ppb = parts per billion = µg/kg = micrograms per kilogram

30. Finding 30: Resolution 92-49

The Regional Board must apply State Water Resources Control Board Resolution 92-49 (hereinafter Resolution 92-49), *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under California Water Code §13304* when setting cleanup levels for contaminated marine sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. In applications dealing with cleanup of contaminated marine sediments Resolution 92-49 is interpreted to require cleanup to background sediment quality unless it is technologically[119] or economically[120] infeasible to do so.

Information concerning Resolution 92-49 has been moved to Section 35 of this Technical Report.

[119] Technological feasibility is determined by assessing available technologies, which have been shown to be effective in reducing the concentration of the pollutants of concern.

[120] Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. The evaluation of economic feasibility includes consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger. Economic feasibility does not refer to the dischargers' ability to finance cleanup. Availability of financial resources is considered in the establishment of reasonable compliance schedules.

31. Finding 31: Background Sediment Quality

The Regional Board derived sediment chemistry levels for use in evaluating the feasibility of cleanup to background sediment quality conditions from the pool of San Diego Bay reference stations described in Finding 15. The background sediment chemistry levels ~~at~~ based on these reference stations are ~~described below.~~ as follows:

Background Sediment Chemistry Levels

Chemical	Units (dry weight)	Background Sediment Chemistry Levels [1]
Metals		
Arsenic	mg/kg	7.5
Cadmium	mg/kg	0.33
Chromium	mg/kg	57
Copper	mg/kg	121
Lead	mg/kg	53
Mercury	mg/kg	0.57
Nickel	mg/kg	15
Silver	mg/kg	1.1
Zinc	mg/kg	192
Organics		
Dibutyltin	µg/kg	21
Monobutyltin	µg/kg	14
Tributyltin	µg/kg	22
Tetrabutyltin	µg/kg	(1.4)
HPAH [2]	µg/kg	673
PPPAH [3]	µg/kg	1,234
Benzo[a]pyrene	µg/kg	202
Total PCB Congeners [4]	µg/kg	84
Polychlorinated terphenyls	µg/kg	(142)

[1] Based on the 95 percent upper prediction limit calculated from a pool of reference stations in San Diego Bay. Parentheses ( ) indicates non-detects accounted for more than or equal to half the values.
[2] HPAH = High Molecular Weight Polynuclear Aromatic Hydrocarbons
[3] PPPAH = Priority Pollutant Polynulear Aromatic Hydrocarbons
[4] PCB = Polychlorinated Biphenyls
Note: A regression analysis of the grain size:metals relationship is used in establishing background sediment chemistry levels. The background metals concentration is based on the 95% UPL using 50% fine grain sediment. These values are conservative concentrations because the mean fine grain sediment at the Shipyard Investigation Site is 70% fine grain sediment. See Appendix for Section 15 for further details on the regression analysis.

31.1 Guiding Principles for Designating Background Sediment Quality Conditions

A discussion of State Water Resources Control Board Resolution 92-49 (*Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304)* and background sediment quality condition is included in Section 35. The Regional Board must apply Resolution 92-49 when setting cleanup levels for contaminated sediment if such sediment threatens beneficial uses of the waters of the state and the contamination or pollution is the result of a discharge of waste. Contaminated sediment must be cleaned up to background sediment quality unless it would be technologically[121] or economically[122] infeasible to do so.

Background conditions for evaluating the feasibility of cleanup to background in marine sediment remediation projects are defined in terms of sediment chemistry, toxicity, and benthic community structure rather than water column chemical pollutant concentrations. This is because protection of water quality involves far more than just water chemistry considerations. Protection of water quality includes protection of the multiple elements which together make up aquatic systems including the aquatic life, wildlife, wetlands, and other aquatic habitat, vegetation, and hydrology required to maintain the aquatic system. Marine sediment provides habitat for many aquatic organisms and functions as an important component of aquatic ecosystems. Adverse effects on organisms in or near sediment can occur even when chemical pollutant levels in the overlying water are low. Various toxic contaminants found only in barely detectable amounts in the water column can accumulate in sediment to much higher levels. Benthic organisms can be exposed to chemical pollutants in sediment through direct contact, ingestion of sediment particles, or uptake of dissolved contaminants present in the interstitial (pore) water. In addition, natural and human disturbances can release pollutants to the overlying water, where pelagic (open-water) organisms can be exposed. Chemical pollutants in sediment can also cause adverse effects either through bioaccumulation and food chain transfer to human and wildlife consumers of fish and shellfish. The accumulation of pollutants in sediment, the toxicity and bioaccumulation of sediment pollutants, and the diversity and composition of the aquatic species are all relevant water quality issues that need to be considered in decisions dealing with contaminated marine sediment cleanup

[121] Technological feasibility is determined by assessing available technologies, which have been shown to be effective in reducing the concentration of the pollutants of concern.

[122] Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. The evaluation of economic feasibility includes consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger. Economic feasibility does not refer to the dischargers' ability to finance cleanup. Availability of financial resources is considered in the establishment of reasonable compliance schedules.

Background sediment quality conditions can be defined in terms of a “pre-industrial background” sediment quality – the relatively pristine, 19th century pre-industrial sediment quality conditions often reflected in deep native marine sediment. Alternatively, background can be defined for existing “surface” marine sediment in terms of an "ambient background” or “contemporary background”, which can be defined as the average surface sediment quality conditions in areas removed from sources of chemical pollutants, recognizing that there may no longer be pristine surface marine sediment in a given geographic area of a waterbody. Ideally, surface sediment station sites used to define “ambient” or “contemporary “ background sediment quality conditions should be collected from a field site that is appreciably free of chemical pollutants and has grain size, total organic carbon, sulfide and ammonia levels, and other characteristics similar to the contaminated marine sediment site.

31.2 Background Sediment Quality and the Reference Condition

The Regional Board derived sediment chemistry levels for use in evaluating the feasibility of cleanup to background sediment quality conditions from the pool of San Diego Bay reference stations as described in Finding 15. The background sediment chemistry levels at these reference stations are described below.

Table 31-1. Background Sediment Chemistry Levels

Chemical	Units (dry weight)	Background Sediment Chemistry Levels [1]
Metals		
Arsenic	mg/kg	7.5
Cadmium	mg/kg	0.33
Chromium	mg/kg	57
Copper	mg/kg	121
Lead	mg/kg	53
Mercury	mg/kg	0.57
Nickel	mg/kg	15
Silver	mg/kg	1.1
Zinc	mg/kg	192
Organics		
Dibutyltin	µg/kg	21
Monobutyltin	µg/kg	14
Tributyltin	µg/kg	22
Tetrabutyltin	µg/kg	(1.4)
HPAH [2]	µg/kg	673
PPPAH [3]	µg/kg	1,234
Benzo[a]pyrene	µg/kg	202
Total PCB Congeners [4]	µg/kg	84
Polychlorinated terphenyls	µg/kg	(142)

[1] Based on the 95 percent upper prediction limit calculated from a pool of reference stations in San Diego Bay. Parentheses ( ) indicates non-detects accounted for more than or equal to half the values.
[2] HPAH = High Molecular Weight Polynuclear Aromatic Hydrocarbons
[3] PPPAH = Priority Pollutant Polynulear Aromatic Hydrocarbons
[4] PCB = Polychlorinated Biphenyls
Note: A regression analysis of the grain size:metals relationship is used in establishing background sediment chemistry levels. The background metals concentration is based on the 95% UPL using 50% fine grain sediment. These values are conservative concentrations because the mean fine grain sediment at the Shipyard Investigation Site is 70% fine grain sediment. See Appendix for Section 15 for further details on the regression analysis.

The background sediment quality conditions presented in Table 31-1 provide an appropriate bench mark to evaluate the cleanup to background sediment quality conditions   This is especially true given that the Regional Board's remediation goal for the Shipyard Sediment Site is to reduce sediment pollutant levels to attain reasonable protection of beneficial uses and not to restore San Diego Bay sediment to 19th century pre-industrial sediment quality conditions.

The background sediment quality condition represents the condition of San Diego Bay away from known sources of chemical pollutants. A detailed description of the reference station selection process is described in the Appendix for Section 15.

The Regional Board believes the background sediment quality conditions presented in this Section will provide reasonable protection of San Diego Bay beneficial uses because:

- From the list of 18 chemicals or combination of chemicals listed in Table 31-1, 11 have published sediment quality guideline values. A comparison of the 11 chemicals to their respective ERMs[123] and ERLs[124] show that all 11 contaminants of concern are below their ERM and 3 of the 11 are also below the ERL. The ERL and ERM values identify ranges in sediment chemistry that are predicted to be rarely (below ERL), occasionally (above ERL but less than ERM), or frequently (above ERM) associated with adverse effects. The Background Sediment Chemistry concentrations fall into the “rare” or “occasional” categories of predicting effects. See Table 31-2 below.
- Mean survival for the amphipod toxicity test for the stations used to define background conditions (i.e. the Reference Condition) is 88 % control adjusted survival. For the 10-day amphipod test, a 72% survival threshold value (80% of the minimum acceptable control survival (90%)) can be used to detect survival significantly less than control (Thursby et al., 1997). This threshold value is very similar to a later published threshold value of 75% survival for the same test using E. estuarius (Phillips et al., 2001). The mean Reference Condition is significantly greater than the two threshold values and is close to the minimum acceptable control survival.
- The mean BRI value for the background condition is 37 (RL 1). From the 16 reference stations used, 11 (69%) of the stations have BRI scores that fall into the “Reference” or “RL 1” categories. RL 1 is defined as > 5% of reference species lost and is considered a marginal change in relative abundance of species. RL 2 through RL 4 is considered to show clear evidence of benthic community disturbance (Ranasinghe et al., 2003). See Table 31-3 below.

[123] Effects Range – Median (ERM) is the median or 50th percentile of effects data for each chemical identified (Long et al., 1995).

[124] Effects Range – Low (ERL) is the lower 10th percentile of the effects data for each chemical identified (Long et al., 1995). It represents the concentration below which toxicity are least likely to occur.

Table 31-2. Background Sediment Chemistry Levels Compared to Sediment Screening Values

Chemical	Units (dry weight)	Background Sediment Chemistry Levels [1]	Effects Range Low [2]	Effects Range Median [2]
Metals				
Arsenic	mg/kg	7.5	8.2	70
Cadmium	mg/kg	0.33	1.2	9.6
Chromium	mg/kg	57	81	370
Copper	mg/kg	121	34	270
Lead	mg/kg	53	46.7	218
Mercury	mg/kg	0.57	0.15	0.71
Nickel	mg/kg	15	20.9	51.6
Silver	mg/kg	1.1	1.0	3.7
Zinc	mg/kg	192	150	410
Organics				
HPAH [3]	µg/kg	673	1700	9600
Total PCB Congeners [4]	µg/kg	84	22.7	180

[1] Based on the 95 percent upper prediction limit calculated from a pool of reference stations in San Diego Bay.
[2] From Buchman, 1999
[3] HPAH = High Molecular Weight Polynuclear Aromatic Hydrocarbons
[4] PCB = Polychlorinated Biphenyls

Table 31-3. Characterization, Definition and BRI-E Thresholds for Levels of Benthic Community Condition

Level	Definition for Bays	BRI-E Threshold
Reference		< 31
Response Level 1	> 5% of reference species lost	31 to 42
Response Level 2	> 25% of reference species lost	42 to 53
Response Level 3	> 50% of reference species lost	53 to 73
Response Level 4	> 80% of reference species lost	> 73

(Ranasinghe et al., 2003)

Justification for each station used in establishing the Reference Condition is provided in Section 15, Table 15-3 and the data and descriptive statistics are provided in the Appendix for Section 15.

Establishing and applying the reference condition as described in Finding 15 and Finding 16 acknowledges the potential for low levels of contamination that is dispersed throughout San Diego Bay and takes into account the natural variability of sediment toxicity and the benthic community condition. The reference or San Diego Bay background condition establishes the current condition that would exist in San Diego Bay minus the influence from Shipyard Sediment Investigation Site.

Although the Reference Condition recognizes some low level of sediment contamination, the levels should still be protective of the beneficial uses.

32. Finding 32: Technological Feasibility Considerations

It is technologically feasible to cleanup to background sediment quality levels at the Shipyard Sediment Site. The Regional Board considered three remedial technologies for the cleanup to background evaluation: (1) Natural Recovery, (2) Subaqueous Capping, and (3) Dredging. Based on current site use, n~~N~~atural recovery ~~was~~ is considered to be technologically infeasible due to sediment disturbance from normal shipyard activities (e.g., vessel propeller wash, ship traffic, dry dock movements, maintenance/navigational dredging, engine tests, construction, etc.). Subaqueous capping ~~was~~ is also considered to be technologically infeasible based on current site use because of the ever-larger ships being serviced at the shipyards, the associated navigational requirements, and the likelihood of cap disturbance resulting from normal shipyard activities (e.g., vessel propeller wash). Dredging, although difficult to implement because the Shipyard Sediment Site is currently a working shipyard, is considered to be technologically feasible. Dredging is a proven technology and it has been used not only in San Diego Bay but also throughout the United States for ~~remediating~~ remediation of contaminated sediment.

32.1 Feasibility to Cleanup to Background Conditions

Technological feasibility is determined by assessing available technologies which have been shown to be effective in either reducing pollutant levels in contaminated marine sediment or isolating contaminated marine sediment from the marine environment.

The feasibility study in the Shipyard Report (Exponent, 2003) identifies and evaluates natural recovery, subaqueous capping, dredging, and treatment as candidate remedial options. Exponent's screening of these candidate remedial options retains natural recovery and dredging for further evaluation, and does not retain subaqueous capping and *in situ* treatment. However, it is expected that the parties subject to the cleanup and abatement order may wish to re-evaluate all remedial options once the final Cleanup Abatement Order containing cleanup levels is issued.

The Regional Board evaluated whether or not it is technologically feasible to cleanup to background using the three readily employable and proven remediation strategies: natural recovery, subaqueous capping, and dredging. A brief description of the Regional Board's evaluation is provided below.

32.1.1 Natural Recovery

Natural recovery involves leaving the contaminated sediment in place and allowing the ongoing aquatic processes to contain, destroy, or otherwise reduce the bioavailability of the sediment pollutants. Natural recovery is a passive form of remedial action that may result in attainment of background pollutant concentrations on the surface of the sediment. If ongoing sources of contamination are controlled, a number of natural processes may diminish the chemical pollutant concentrations in surface sediment over time. The most important natural recovery process in a depositional environment is burial of contaminated sediment by relatively uncontaminated naturally accumulating particles with pollutant reduction or sequestration by physical, chemical, or biological processes.

Natural recovery is appropriate when:

- Surficial sediment concentrations of pollutants are low,
- The pollutant discharge source has been halted,
- Burial or dilution processes are rapid,
- Environmental effects of cleanup are more damaging than allowing the sediment to remain in place, and
- Sediment will not be remobilized by human or natural activities (e.g. severe storms) (U.S. EPA, 1993b).

Among the limitations of natural recovery are that contaminated sediment burial occurs only in depositional areas and even these areas can be subject to sediment bed re-suspension by storms or anthropogenic processes. Other disadvantages are that the science of natural recovery is poorly understood. For example, the in-bed processes that govern chemical pollutant containment or destruction are not well understood, and measurement can be difficult because of the complexity and variability of natural processes. The current lack of the capability of quantifying chemical pollutant movements accurately precludes a definite determination of the risk posed at a site being considered for remediation by natural recovery. It is seldom known, for example, the percentages of chemical pollutants undergoing intrinsic degradation that are released to the water column by passive processes, such as diffusion, or by active biological processes (e.g. extracted by organisms migrating and feeding), or are moved by erosion and re-suspension (NRC, 1997).

Based on current site use for shipbuilding and repair activities, most likely, there will be sediment disturbances due to ship launching and other ship movements, (e.g. propeller wash) that would result in resuspension of the sediment pollutants. In addition, the infrequent need for maintenance dredging at the shipyard sediment site (Chee, 2004; Halvax, 2004) suggests that the deposition rates for new sediment, that might bury or dilute contaminants, are very low. Therefore, based on current site use and site characteristics, natural recovery is considered to be technologically infeasible.

32.1.2 Subaqueous Capping

In-place capping is placement of clean material on top of the contaminated sediment to effectively isolate the sediment pollutants from contact with the benthic community. Capping material is typically sand, silty to gravelly sand, and/or armoring material. Effective capping requires sufficient cap thickness, cap placement to avoid disturbance, and cap integrity maintenance from disturbances. Capping also requires monitoring to ensure integrity and effectiveness. Capping is an engineered procedure that can be used at appropriate sites, and its success depends on the careful design, construction, and long-term maintenance of the cap.

In-place capping also has some potential drawbacks. Capping can destroy or change the existing benthic community structure at a site. If caps are made of different materials than the ambient bottom sediment, they may alter the benthic community. Capping may not be appropriate where the cap may be disrupted or scoured (e.g., from high-energy conditions, or heavy boat traffic) or where navigation dredging is a necessity. Caps may be subject to penetration and destruction by deep burrowing marine organisms (bioturbation). Long-term monitoring is required to determine the effectiveness of capping

As identified in Section 32.1.1 above, based on current site use for shipbuilding and repair activities, and the potential for sediment disturbances due to ship launching and other ship movements, the Shipyard Sediment Site is not a viable candidate for in-place capping. In addition, the depths needed for current operations may not allow for sufficient cap thickness. Therefore, based on current site use, subaqueous capping is considered technologically infeasible.

32.1.3 Dredging

Dredging is the most common method employed at contaminated sediment sites. Dredging is the physical removal of sediment from a water body. According to the U.S. EPA, 150 sites on National Priorities List involved contaminated sediment and approximately 30 percent of the sites included a decision that specified dredging or excavation as the sediment cleanup method (U.S. EPA, 2005a).

Technical feasibility refers to a technology’s implementability or whether it is physically possible to effect cleanup given the physical constraints existing at the site. Some of the factors at the Shipyard Sediment Site that are conducive to dredging include:

- Proximity to shore and infrastructure to facilitate staging of equipment and transportation of dredged material;
- Water depth deep enough for dredge equipment, yet not too deep for operations;
- Contaminated sediment is underlain by clean, more resistant sediment to facilitate identification of dredge limits; and
- Contaminated sediment is generally in contiguous, discrete areas.

Some of the potential limitations to dredging are:

- Dredging is typically a more complex operation than natural recovery or in-situ capping due to the need to transport and dispose of the material;
- The presence of infrastructure, such as piers and pilings, makes dredging more difficult due to access constraints;
- The site operations such as ship berthing and ship movements increase the complexity of planning and executing a dredging operation; and
- Sufficient area for staging equipment and handling and transporting dredged materials.

An environmental dredging operation also has to consider the potential alteration of habitat and the resuspension of sediment and the associated release of pollutants to previously unpolluted areas. Based on the available data, it appears that the total amount of sediment "lost" to resuspension is 2 to 5 percent of the in situ volume (NRC, 1997). However, this small percentage does not necessarily mean that sediment resuspension is not a concern. The loss of even 1 percent of certain pollutants could be a substantial problem. However, specialty dredges have been designed to reduce resuspension during dredging operations and are effective in removing sediment with a minimum of resuspension. In addition, field tests indicate that conventional dredges, if operated with care, can also remove sediment with low levels of resuspension (NRC, 1997).

32.2 Conclusion

Although there are complexities and difficulties that would need to be addressed and overcome (e.g. removal and handling of large volume of sediment; obstructions such as piers and ongoing shipyard operations; transportation and disposal of waste), the Regional Board concludes that it is technologically feasible to cleanup to the background sediment quality levels defined in Section 31. Maintenance and navigational dredging, as well as environmental dredging for cleanup, has been successfully performed at thousands of sites, including several in San Diego Bay, and many of these projects have successfully overcome the same types of operational limitations present at the Shipyard Sediment Site, such as piers and other obstructions, ship movements, and limited staging areas.

33. Finding 33: Economic Feasibility Considerations

It is economically infeasible to cleanup to background sediment quality levels at the Shipyard Sediment Site. The Regional Board evaluated a number of criteria to determine tradeoffs in risks, costs, and benefits associated with cleanups between the to background sediment chemistry levels defined above and six alternative cleanup levels greater than background. The criteria included factors such as total cost, volume of sediments dredged, short- and long-term effects on beneficial uses (aquatic life, aquatic-dependent wildlife, and human health), effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources. Based on these considerations, the Regional Board concludes concluded that it is not economically feasible to cleanup to the background sediment chemistry levels. The overall benefit of conducting cleanup at background sediment quality is approximately equal to the overall benefit of achieving cleanup at levels 5 times greater than background[125]. Furthermore, the total cost to cleanup to background versus the total cost to cleanup to levels 5 times greater than background is significantly higher. There is an estimated $26,000,000 difference in total costs between cleanup to background and cleanup to 5 times background.

Summary Of Economic Feasibility Evaluation

Cleanup Alternatives	Approximate Dredge Volume (cu yd)	Approximate Total Cost
Natural Recovery	*0*	*$900,000*
Exponent LAET	*75,000*	*$15,000,000*
20x Background	*252,060*	*$33,000,000*
15x Background	*295,460*	*$37,000,000*
10x Background	*502,450*	*$58,000,000*
5x Background	*885,580*	*$96,000,000*
Background	*1,200,000*	*$122,000,000*

[125] Many of the elevated chemical concentrations exist in the same area, cleaning up some chemicals to 5 times background will result in the reduction of the majority of chemicals to levels much lower than 5 times background as reflected in the table in Finding 37 Alternitive Cleanup Levels.

~~**Summary Of Economic Feasibility Evaluation (continued)**~~

~~**Cleanup Alternatives**~~	~~**Short-Term Effects**~~			~~**Long-Term Effects**~~			~~**Effects on Shipyards & Economic Activities**~~	~~**Effects on Local Businesses & Neighborhoods**~~	~~**Effects on Aquatic Resources**~~
	~~**Aquatic Life**~~	~~**Wildlife**~~	~~**Human Health**~~	~~**Aquatic Life**~~	~~**Wildlife**~~	~~**Human Health**~~			
~~*Natural Recovery*~~	~~*0*~~	~~*0*~~	~~*0*~~	~~*-4*~~	~~*-5*~~	~~*-5*~~	~~*0*~~	~~*0*~~	~~*0*~~
~~*Exponent LAET*~~	~~*-1*~~	~~*-1*~~	~~*-2*~~	~~*+2*~~	~~*+1*~~	~~*+1*~~	~~*-1*~~	~~*-1*~~	~~*+1*~~
~~*20x Background*~~	~~*-3*~~	~~*-1*~~	~~*-3*~~	~~*+3*~~	~~*+3*~~	~~*+3*~~	~~*-3*~~	~~*-3*~~	~~*+3*~~
~~*15x Background*~~	~~*-3*~~	~~*-1*~~	~~*-3*~~	~~*+3*~~	~~*+3*~~	~~*+3*~~	~~*-3*~~	~~*-3*~~	~~*+3*~~
~~*10x Background*~~	~~*-4*~~	~~*-1*~~	~~*-4*~~	~~*+3*~~	~~*+3*~~	~~*+4*~~	~~*-3*~~	~~*-3*~~	~~*+3*~~
~~*5x Background*~~	~~*-4*~~	~~*-2*~~	~~*-4*~~	~~*+4*~~	~~*+4*~~	~~*+5*~~	~~*-4*~~	~~*-4*~~	~~*+4*~~
~~*Background*~~	~~*-4*~~	~~*-2*~~	~~*-4*~~	~~*+4*~~	~~*+4*~~	~~*+5*~~	~~*-4*~~	~~*-4*~~	~~*+4*~~

~~**Note:** Scores are given on the basis of the degree of positive or negative effects relative to a neutral baseline condition (i.e., current condition at the Shipyard Sediment Site). Scores range from +5 (major improvement compared to current conditions) to -5 (major adverse effects compared to current conditions).~~

33.1 Evaluation of economic feasibility of cleaning up to background

Economic feasibility refers to the objective balancing of the incremental benefit of attaining more stringent cleanup levels compared with the incremental cost of achieving those levels. Economic feasibility does not refer to the subjective measurement of the shipyards' ability to pay the costs.

Seven alternative cleanup levels were evaluated by comparing the incremental benefit with the incremental cost. These cleanup alternatives, ranging from natural recovery to cleanup to attain background conditions, are provided in Table 33-1. The 5x Background, 10x Background, 15x Background, and 20x Background cleanup alternatives in Table 33-1 refer to chemical concentrations as multiples of the background levels presented in Section 31 Background Sediment Quality. Since many of the elevated chemical concentrations occur in the same areas of the site, the NOAA analyses indicates that the largest cleanup footprint is determined by the three chemicals: polychlorinated biphenyls (PCBs), tributyltin (TBT), and benzo[a]pyrene (BAP). Therefore the approximate dredge volumes presented for each of the "multiple of background" scenarios (i.e. 5x Background, 10x Background, 15x Background, and 20x Background) are based on PCBs, TBT, and BAP and the other chemical pollutants will likely be reduced to levels lower than indicated by the multiple label of the alternative (see Section 34, Table 34-1).

Table 33-1. Cleanup Alternatives and Estimated Costs

Cleanup Alternatives	Approximate Dredge Volume (cubic yards)	Approximate Total Cost	Approximate Cost per Cubic Yard
Natural Recovery	0	$900,000	not applicable
Exponent LAET*	75,000	$15,000,000	$200
20x Background	177,000	$32,000,000	$179
15x Background	198,000	$35,000,000	$175
10x Background	401,000	$52,000,000	$130
5x Background	754,000	$88,000,000	$117
Background	1,200,000	$122,000,000	$102

The approximate dredge volumes and total cost values presented in Table 33-1 for the natural recovery, Exponent LAET, and background alternatives are from the Shipyard Report (Exponent, 2003). For the other alternatives the dredge volumes are based on analyses performed by NOAA (MacDonald, 2005).

The approximate cost per cubic yard for the 5x Background alternative is based on Table 18-4 in the Shipyard Report, revised to adjust for volume differences. The approximate cost per cubic yard for the 10x Background, 15x Background, and 20x Background alternatives are calculated using the costs for the 5x Background alternative and the costs provided in the Shipyard Report for natural recovery, Exponent LAET, and background. The approximate total cost was estimated by multiplying the approximate cost per cubic yard times the approximate dredge volume. See Appendix for Finding 33 for more information on the calculations in Table 33-1.

Table 33-2 summarizes the results of the Regional Board's balanced comparison of the anticipated environmental and public health benefits of actions with their costs, including possible environmental and health risks for various cleanup alternatives. The following criteria were evaluated using a subjective scale from +5 to –5:

- Short-term and long-term effects on aquatic life;
- Short-term and long-term effects on wildlife;
- Short-term and long-term effects on human health;
- Effects on shipyards and associated economic activities;
- Effects on local businesses and neighborhoods; and
- Effects on Recreational and Commercial Uses of Aquatic Resources.

These are generally the same criteria used in the Shipyard Report (Exponent, 2003). The results are presented in Table 33-2. The results of the Shipyard Report's evaluation of the cleanup to background alternative is also presented in the last row of Table 33-2.

Scores are based on the degree of positive or negative effects relative to a neutral baseline condition (i.e. current condition). Scores range from +5 (major improvement to current conditions) to –5 (major adverse effects from current conditions). The Appendix for Finding 33 presents information provided in the Shipyard Report for the Remediation to Final Reference Pool Chemistry Alternative regarding each criterion with respect to the cleanup to background alternative. Regional Board provides comments for those criteria where scores differ. The discussion in the Appendix also includes a summary of the rationale presented in the Shipyard Report.

Table 33-2. Cleanup Alternatives and Potential Benefits

Cleanup Alternatives	Short-Term Effects			Long-Term Effects			Effects on Shipyards & Economic Activities	Effects on Local Businesses & Neighborhoods	Effects on Aquatic Resources
	Aquatic Life	Wildlife	Human Health	Aquatic Life	Wildlife	Human Health			
Natural Recovery	0	0	0	-4	-5	-5	0	0	0
Exponent LAET	-1	-1	-2	+2	+1	+1	-1	-1	+1
20x Background	-3	-1	-3	+3	+3	+3	-3	-3	+3
15x Background	-3	-1	-3	+3	+3	+3	-3	-3	+3
10x Background	-4	-1	-4	+3	+3	+4	-3	-3	+3
5x Background	-4	-2	-4	+4	+4	+5	-4	-4	+4
Background	-4	-2	-4	+4	+4	+5	-4	-4	+4
Background (from Shipyard Report)	-5	-2	-5	+2	-1	0	-5	-5	-1

33.2 Comparison of Incremental Cost Versus Incremental Benefit

A comparison of the potential benefits for each effects category in Table 33-2 indicates that there is no discernable improvement in positive effect, or reduction in negative effect, in other words no apparent incremental benefit, as the cleanup level increases from the 5x Background alternative to the Background alternative. Yet the estimated cost increases by approximately $34 million, nearly 40 percent, from approximately $88 million to $122 million.

A similar comparison of incremental cost versus incremental benefit between the 10x Background alternative and the 5x Background alternative indicates that $36 million in additional cost achieves an incremental improvement in long-term effects on aquatic life, wildlife, and human health, as well as aquatic resources (see Table 33-2). Note that an improvement in a long-term effects category is judged to outweigh an increase in a short-term adverse effect. For example, a change from +3 to +4 in long-term effect on wildlife is judged to outweigh a change from –1 to –2 in short-term effect on wildlife since, by definition, a long-term effect lasts longer than a short-term effect.

Based on these incremental costs versus incremental benefit comparisons, the Regional Board concludes that it is not economically feasible to cleanup to background sediment quality levels.

34. Finding 34: Alternative Cleanup Levels

The Regional Board has selected the alternative cleanup levels presented below for the Shipyard Sediment Site. In approving alternative cleanup levels less stringent than background the Regional Board has considered the factors contained in Resolution 92-49 and the California Code of Regulations, Title 23, section 2550.4, subdivision (d)[126].

a. ***Alternative Cleanup Levels are Appropriate***. The Regional Board has determined that it is economically infeasible to cleanup to background sediment quality levels at the Shipyard Sediment Site. The overall benefit of remediating the site to the alternative cleanup levels is approximately equal to the overall benefit of cleaning up to background for considerably less cost. NASSCO and Southwest Marine's Sediment Investigation Report indicates that attainment of background sediment quality is not feasible because it would require removal of approximately 1,200,000 cubic yards of sediment at a cost of $122,000,000. Removal of that much sediment would be extremely expensive; cause harm to beneficial uses from the large-scale dredging (due to physical disturbance of habitat and re-suspension of pollutants into the water column); and cause substantial disruption of streets, businesses, and neighborhoods while producing little or no benefit to beneficial uses over that which could be attained from the alternative cleanup levels based on 5 times background.

b. ***Alternative Cleanup Levels Are Consistent With Water Quality Control Plans And Policies.*** The alternative cleanup levels will not result in water quality less than prescribed in water quality control plans and policies adopted by the State Water Resources Control Board and the Regional Board[127]. The alternative sediment quality levels are well below levels expected to cause toxicity to aquatic life and will substantially reduce existing risks to aquatic dependent wildlife and human health.

[126] Resolution 92-49 provides that in approving any alternative cleanup levels less stringent than background sediment quality the Regional Board must consider the conditions described in California Code of Regulations, Title 23, section 2550.4. Resolution 92-49 further requires that any alternative cleanup levels shall (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial use of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

[127] Applicable numerical and narrative water quality objectives for San Diego Bay Waters include the Regional Board's Toxicity Objective, the California Toxics Rule Water Quality Criteria, and the State Water Board Policy for Implementation of Toxics Standards (the SIP) which provides that mixing zones shall not result in "objectionable bottom deposits." This term is defined as "an accumulation of materials… on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediments (SWRCB, 2005).

c. ***Alternative Cleanup Levels Are Consistent With The Maximum Benefit To The People Of The State.*** The level of water quality that will be attained upon implementation of the alternative cleanup levels at the Shipyard Sediment Site is consistent with the maximum benefit to the people of the state. The San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act 303(d) list for elevated levels of copper, mercury, ~~polynuclear aromatic hydrocarbons (~~PAH~~)~~, and ~~polychlorinated biphenyls (~~PCB~~)~~ at the Shipyard Sediment Site. While it is impossible to determine the precise level of water quality that will be attained given the residual sediment pollutants constituents that will remain at the site, compliance with the alternative cleanup levels will markedly improve water quality conditions in the Shipyard Sediment Site and result in attainment of water quality standards at the site.

Alternative Sediment Cleanup Levels

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels [1]
Metals		
Arsenic	mg/kg	10
Cadmium	mg/kg	1.0
Chromium	mg/kg	81
Copper	mg/kg	200
Lead	mg/kg	90
Mercury	mg/kg	0.7
Nickel	mg/kg	20
Silver	mg/kg	1.5
Zinc	mg/kg	300
Organics		
Tributyltin	μg/kg	110
Benzo[a]pyrene	μg/kg	1,010
Total PCB Congeners [2]	μg/kg	420

[1] Cleanup levels for tributyltin, benzo[a]pyrene, and total PCB congeners are based on 5 times background, constituents which, at 5 times background, determine the largest cleanup footprint. The other chemical concentrations are based on an evaluation of that cleanup footprint.

[2] PCB = polychlorinated biphenyl

34.1 Regional Board Selected Sediment Cleanup Levels

The selected sediment cleanup levels are also referred to as alternative cleanup levels because they are alternative cleanup levels greater than background. The alternative sediment cleanup levels presented in Table 34-1 are reasonably protective of aquatic life, aquatic-dependent wildlife, and human health beneficial uses designated for San Diego Bay. Table 34-1 shows the comparison of the alternative cleanup levels with the background levels. Tributyltin (TBT), benzo[a]pyrene, and polychlorinated biphenyls (PCBs) are 5 times the background levels set for those chemical pollutants as described in Section 31. Alternative sediment cleanup levels for the other constituents are between 1 and 3 times the background levels set for those chemical pollutants in Section 31.

Table 34-1. Alternative Sediment Cleanup Levels

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels	Background	Multiple
Metals				
Arsenic	mg/kg	**10**	7.5	1.3x
Cadmium	mg/kg	**1.0**	0.33	3x
Chromium	mg/kg	**81**	57	1.4x
Copper	mg/kg	**200**	121	1.7x
Lead	mg/kg	**90**	53	1.7x
Mercury	mg/kg	**0.7**	0.57	1.2x
Nickel	mg/kg	**20**	15	1.3x
Silver	mg/kg	**1.5**	1.1	1.6x
Zinc	mg/kg	**300**	129	2.3x
Organics				
Tributyltin	µg/kg	**110**	22	5x
Benzo[a]pyrene	µg/kg	**1,010**	202	5x
Total PCB Congeners	µg/kg	**420**	84	5x

34.2 Evaluation of Alternative Cleanup Levels

The Regional Board evaluated the selected alternative cleanup levels in terms of their ability to protect beneficial uses by the following methods:

- Comparison to Lowest Adverse Effects Threshold (LAET);
- Comparison of estimated cleanup area footprint to the location of stations where the triad results indicate likely impairment;
- Comparison of predicted sediment concentrations based on the California Toxic Rule using the relationship between pore water and sediment concentrations;
- Comparison to effects range low (ERL) and effects range median (ERM) sediment quality guidelines;
- Evaluation of theoretical post-cleanup human health risks; and
- Comparison of cleanup levels to screening levels to protect wildlife.

34.2.1 Comparison to Lowest Adverse Effects Threshold

The Regional Board evaluated the potential threat to aquatic life from exposure to the sediment pollutant cleanup levels by comparing the cleanup levels to selected nationally recognized sediment screening levels. The screening level selected for this comparison in this section is based on the Apparent Effects Thresholds (AETs) methodology for selected organics and metals developed by Barrick et al. (1988). The principles behind the development of these sediment chemistry screening values are presented first followed by the cleanup level comparison analysis.

34.2.1.1 Adverse Effects Threshold Principles

The Apparent Effects Threshold (AET) approach is a tool for identifying concentrations of a pollutant in sediment above which adverse biological effects (e.g. amphipod mortality in bioassays, depressions in the abundance of benthic infauna, and bioaccumulation) are always expected.

The focus of the AET approach is to identify concentrations of contaminants that are associated exclusively with sediment exhibiting statistically significant biological effects relative to reference sediment. AETs for each chemical and biological indicator are developed using the following steps:

1. Collect paired chemical and biological effects data – chemical and biological effects testing on subsamples of the same field sample is conducted.
2. Identify “impacted” and “nonimpacted” stations – the statistical significance of adverse biological effects relative to suitable reference conditions for each sediment sample and biological indicator is tested.

3. Identify the AET using only “nonimpacted” stations – for each chemical, the AET is identified for a given biological indicator as the highest detected concentration among sediment samples that did not exhibit statistically significant effects.
4. Verify that statistically significant biological effects were observed at a chemical concentration higher than the AET; otherwise, the AET was only a preliminary minimum estimate.
5. Repeat steps 1-4 for each biological indicator.

With multiple pollutants, several AET values can be combined to derive a single set of AET values by using the lowest of any of the individual AET values for each chemical. This is known as the lowest AET or LAET. Additional details on the derivation of LAET values for the Shipyard Sediment Site are provided in the Shipyard Report (Exponent, 2003).

Biological effects correlation approaches, such as ERMs and AETs, are based on the evaluation of paired field and laboratory data to relate incidence of adverse biological effects to the sediment concentration of a specific chemical at a particular site. These data sets are used to identify level-of-concern chemical concentrations based on the probability of observing adverse effects. Exceedance of the level-of-concern concentrations is associated with a likelihood of an adverse organism response; however, it does not demonstrate that a particular chemical is solely responsible.

These correlative procedures differ from one another by design and, subsequently, how they relate to sediment toxicity. For example, concentrations above ERMs are levels “usually” associated with adverse effects, whereas concentrations above AETs are levels intended to “always” be associated with adverse effects. Thus, by screening cleanup levels by comparing them to ERMs, the likelihood of a false negative (i.e., incorrectly concluding that the sediment is not toxic) is minimized and by comparing cleanup levels to AETs, the likelihood of a false positive (i.e., incorrectly concluding that the sediment is toxic) is minimized. Therefore, to be protective of aquatic life and reduce the likelihood of a false negative, a margin of safety should be considered when using the AET to evaluate the degree of beneficial use protection provided by the sediment cleanup levels.

34.2.1.2 Comparison of Cleanup Levels to Lowest Adverse Effects Threshold

The Shipyard Report provides LAET results for representative chemicals from the major classes of sediment pollutants. The major chemical classes are metals, butyltins, PCBs and PCTs, PAHs, and petroleum hydrocarbons. The representative chemical selected from each class includes all metals (arsenic, copper, lead, mercury, and zinc) except for selenium, TBT, PCB homologs, HPAHs, and DRO (diesel range organics) and RRO (residual range organics). For the AET derivation, the Final Reference Pool of data was used in assessing toxicity and benthic community affects. Also included in the Shipyard Report is a section that assesses the reliability and sensitivity of the AET values. This analysis can be found in Section 9.3 of the Shipyard Report (Exponent, 2003).

The Regional Board also calculated LAET results using the Reference Condition described in Finding 15. The results for each representative chemical were very similar to the findings in the Shipyard Report. Most of the AETs were established by the highest chemical concentration and it is likely that the actual AET may be higher than the maximum concentration measured. DRO and RRO were not carried over in the Regional Board's analysis because these chemicals were not measured in the Chollas and Paleta study. See Table 34-2 below.

As indicated in Table 34-2, all of the alternative cleanup levels are below the Shipyard LAET by a margin of safety varying from 2.7 to 95 times. The alternate sediment cleanup levels are far below the Shipyard and Regional Board LAET and, in most cases, below the AET levels derived by the State of Washington for the Puget Sound area (Buchman, 1999). The proposed sediment cleanup levels are below both the Shipyard Sediment Site investigation LAETs and the State of Washington AETs, therefore, the alternate sediment chemistry cleanup levels should be protective of the benthic communities in San Diego Bay. It should be noted however the LAET does not take into account the risk to human health risk or aquatic-dependent wildlife.

Table 34-2. Comparison of Cleanup Levels to LAET

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels	AET (Buchman, 1999)	LAET (Shipyard Report)	LAET (RWQCB)
Arsenic	mg/kg	10	35	27	27.2 G
Copper	mg/kg	200	390	1,000	1,030
Lead	mg/kg	90	400	250	248
Mercury	mg/kg	0.7	0.4	2.5	3.92 G
Zinc	mg/kg	90	410	1,200	1,200 G
PP-PAHs[3]	mg/kg	0.7	-[1]	-[2]	29
TBT	µg/kg	20	>3.4	1,900	1,900
PCBs	µg/kg	420	130	3,000	5,635 G

[1]Buchman (1999) provides an HPAH value of 7.9 mg/kg, but no PPAH value is given.
[2]The Shipyard Report (Exponent, 2003) provides an HPAH value of 26 mg/kg, but no PPAH value is given. G Represents the highest chemical concentration measured. Actual AET may be higher.
[3]PP-PAHs = Sum of Priority Pollutant PAHs (SCCWRP and U.S. Navy, 2005b)

34.2.2 Comparison to Triad Results

There are 14 surface sediment sampling stations at the Shipyard Sediment Site where the Triad results indicate it is likely that the pollutants present in the sediment are adversely impacting the organisms living in or on the sediment (see Section 16.0, Sediment Quality Triad Results). Figure 34-1 below shows the location of these 14 stations relative to the potential remediation area and these 14 Triad stations fall with in, or immediately adjacent to, that area. The potential remediation area defined by the alternative cleanup levels will encompass those areas where the Triad results indicate likely adverse impacts to the benthic community. In addition, the potential remediation area also encompasses most of the 16 stations where the Triad results indicate “possible” adverse impacts to the benthic community. Note that the potential remediation area is estimated based on limited data and the actual area associated with the selected cleanup levels may differ from that indicated.

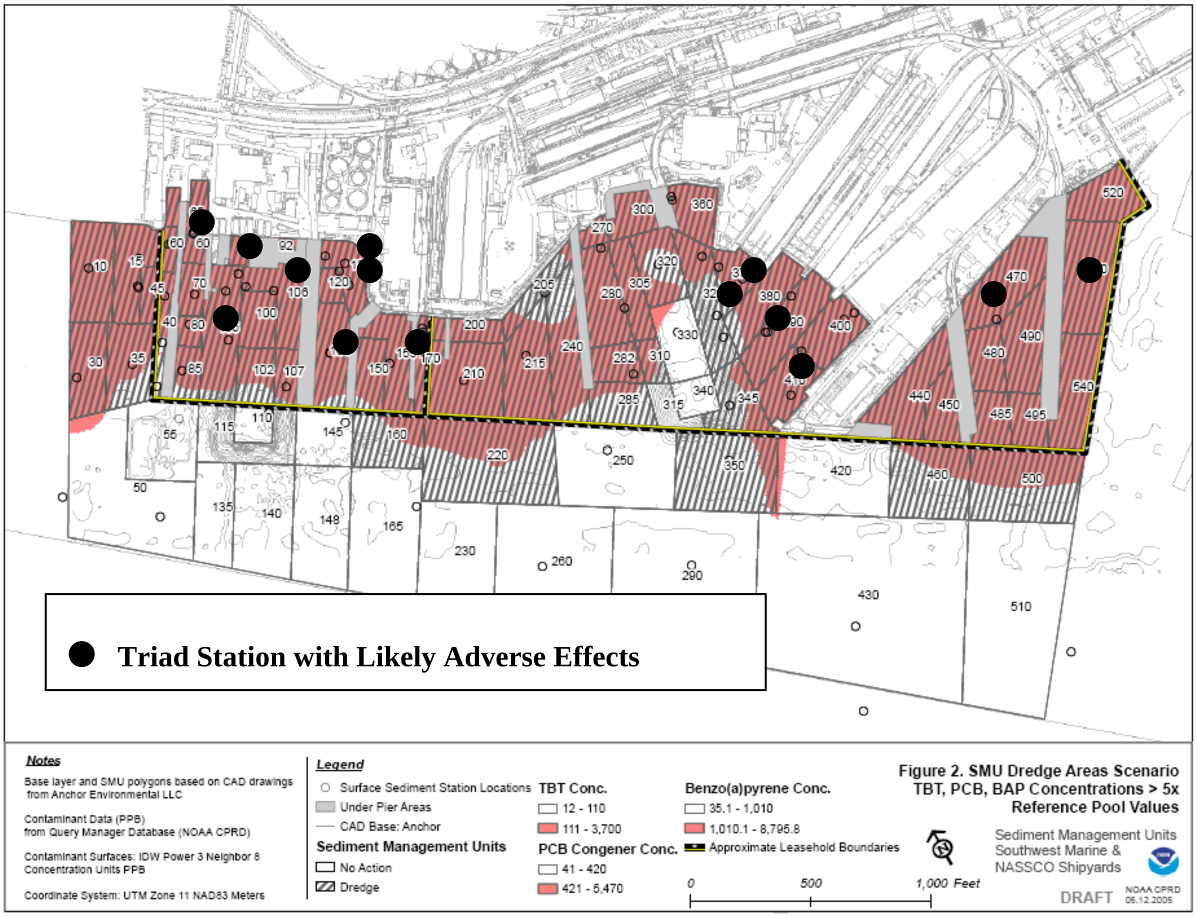

Figure 34-1. Comparison of Potential Dredge Outline with Triad Results

34.2.3 Comparison to California Toxic Rule

On May 18, 2000, the U.S. EPA promulgated in 40 CFR 131.38, numeric water quality criteria for priority toxic pollutants and other provisions for water quality standards, known as the California Toxics Rule (CTR). The CTR water quality criteria are applicable as water quality objectives in California's inland surface waters, enclosed bays, and estuaries.

The Shipyard Report used the relationship between pore water concentrations and sediment concentrations at a number of stations to predict what sediment cleanup levels would be associated with pore water concentrations at the CTR level. This approach uses equilibrium partitioning theory to relate a pore water concentration to a sediment concentration. As the Shipyard Report discusses, there are a number of potential difficulties in applying this type of analysis, such as establishing a good relationship between pore water and sediment concentrations. The lower the correlation between pore water and sediment concentrations, the lower the confidence on the prediction.

According to the Shipyard Report:

> "*statistically significant ($p<0.05$) relationships between pore water and sediment were found for copper, lead, mercury, zinc, TBT, and PCBs. No relationship between pore water and sediment was found for arsenic, chromium, nickel, and silver.*"

The R-squared values for the regressions between sediment chemistry and pore water for copper, lead, mercury, zinc, TBT, and PCBs range from approximately 60 percent to 85 percent (Exponent, 2003). Theoretically the pore water concentrations should reach zero when the sediment concentrations reach zero. The Shipyard Report discusses the observation that for copper, lead, mercury, zinc, and PCBs, the regression has a positive intercept that is statistically significantly different from zero. The samples were not filtered in accordance with U.S. EPA guidance (U.S. EPA, 2001b). Therefore, one possible source of this positive intercept may be the presence of very fine suspended or colloidal material in the samples. The samples were centrifuged to remove the sediment from the samples.

Table 34-3 shows the Shipyard Report's revised predicted sediment concentration based on applying the CTR values to the pore water. The Shipyard Report's revised upper and lower limits on the confidence interval are also provided in Table 34-3 (Exponent, 2005).

For lead, mercury, and zinc, the alternative sediment cleanup levels are below the CTR predicted sediment concentrations. For copper and PCBs, the cleanup levels are above the predicted concentrations. However for those pollutants, the confidence interval is very large, indicating greater uncertainty in the analysis.

Table 34-3. Comparison of Cleanup Levels to California Toxic Rule Predicted Sediment Concentration

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels	CTR Predicted Sediment Concentrations	R-squared Values	Lower Limit	Upper Limit
Copper	mg/kg	**200**	90	0.73	-367	494
Lead	mg/kg	**90**	180	0.75	67	312
Mercury	mg/kg	**0.7**	35	0.63	19	93
Zinc	mg/kg	**90**	5958	0.61	2,969	16,296
PCBs	µg/kg	**420**	215	0.85	-15	1,020

(Exponent, 2003; Exponent, 2005)

34.2.4 Comparison to Effects Range Low (ERL) and Effects Range Median (ERM) Criteria

The potential threat to aquatic life from the sediment pollutant cleanup levels was evaluated by comparing the cleanup levels to nationally recognized sediment screening levels. For the purpose of this analysis, the screening levels selected was the effects range-median (ERM) and effects range-low (ERL) values for selected nonionic organics and metals developed by Long et al., 1995. The principles behind the development of these sediment chemistry screening values are presented first followed by the cleanup level comparison analysis.

34.2.4.1 Effects Range Low (ERL) and Effects Range Median (ERM) Principles

The "effects range" approach for deriving sediment quality guidelines involves matching dry-weight sediment contaminant concentrations with associated biological effects data originally developed informal sediment quality guidelines (SQGs) using this approach for evaluation of the National Oceanic and Atmospheric Administration's (NOAA) National Status and Trends (NS&T) data (Long and Morgan, 1990). The SQGs were not promulgated as regulatory criteria or standards and thus were not intended for use as cleanup or remediation targets (NOAA, 1999). SQGs can be used to classify sediment samples with regard to potential for sediment toxicity, identifying contaminants of potential concern, and identifying areas of concern based on the number and magnitude of SQG exceedances.

Data from equilibrium partitioning modeling, laboratory, and field studies conducted throughout North America were used to determine the concentration ranges that are rarely, occasionally, or frequently associated with toxicity for marine and estuarine sediment. ERL and ERM values were derived by Long et al., (1995) for 28 chemicals or classes of chemicals: 9 trace metals, total PCBs, 13 individual polynuclear aromatic hydrocarbons (PAHs), 3 classes of PAHs (total low molecular weight, total high molecular weight, and total PAH), and 2 pesticides (p,p'-DDE and total DDT). For each chemical, sediment concentration data with incidence of observed adverse biological effects were identified and ordered. From the ascending data tables the 10th percentile and the 50th percentile (median) were identified for each chemical.

The ERL criteria were established using the lower 10th percentile chemical concentration of effect data for each chemical. The ERM criteria were established using the 50th percentile chemical concentration from the effects data for each chemical. In terms of biological effects, sediment chemical concentrations below the ERL represent the "minimal-effects range" where adverse biological effects rarely occur. Sediment concentrations between the ERL and the ERM, represent a "possible-effects range" within which adverse biological effects would occasionally occur. The sediment chemical concentrations above the ERM value represent a "probable-effects range" within which adverse biological effects frequently occur (Long et al., 1995). Some approved TMDLs for contaminants in sediment in California bays and estuaries have used ERL or ERM values as numeric targets (e.g., the California Regional Water Quality Control Board Los Angeles Region's Ballona Creek Estuary for Toxic Pollutants TMDL).

The accuracy of the ERL and ERM sediment quality guidelines was evaluated using the data in the database not associated with adverse effects and noting whether the incidence of effects was less than 25 percent in the minimal-effects range, increased consistently with increasing chemical concentrations, and was greater than 75 percent in the probable-effects. Long et al., 1995 reported that these sediment quality guidelines were most accurate for copper, lead, silver, and all classes of PAHs and most of the individual PAHs; however, accuracy was low for nickel, chromium, mercury, total PCBs, and DDE and DDT. The variability in the chemical concentrations associated with effects is attributed to differences in sensitivities of different taxa and physical factors that affect bioavailability (Long et al., 1995). The ERL and ERM guidelines generally agreed within factors of 2 to 3 with other guidelines.

The accuracy of the ERL and ERM guidelines in correctly predicting nontoxicity and toxicity has also been determined empirically among field-collected samples (U.S. EPA., 1997d)[128]. The results of the analyses (summarized in Table 34-4) suggest that highly toxic responses occurred in 12 percent of the samples in the amphipod tests and 28 percent of the samples in any one of the tests performed when all chemical concentrations were less than their respective ERL values. When one or more chemicals exceeded ERL concentrations, but all concentrations were lower than the ERM concentrations, the percentages of samples indicating high toxicity were 19 percent in the amphipod tests and 64 percent in any one of the tests performed. The incidence of high toxicity in the amphipod tests increased from 10 percent when only one ERL value was exceeded to 58 percent when 20 to 24 ERLs were exceeded. The incidence of toxicity in any one of the tests increased from 29 percent when only one ERL was exceeded to 91 percent when 20 to 24 ERLs were exceeded. In samples where one or more ERMs were exceeded, the incidence of high toxicity was 42 percent in amphipod tests and 80 percent in any one of the battery of tests performed. If both the significant and highly toxic results were combined in the samples, the percentage of samples indicating toxicity increases to 55 percent in amphipod tests and 87 percent in any one of the tests. As with the ERLs, the incidence of toxicity increased with increasing number of chemicals that exceeded the ERMs.

Table 34-4. Incidence of Toxicity in Amphipod Survival Tests Alone and Any One of 2-4 Tests Performed

Chemical Concentrations	Amphipod Tests Alone			Any Test Performed		
	% Not Toxic	% Significant Toxicity	% Highly Toxic	% Not Toxic	% Significant Toxicity	% Highly Toxic
All < ERLs	64	23	12	67	5	28
>1 or more ERLs	59	22	19	20	15	64
>1 or more ERMs	45	13	42	13	7	80

(U.S. EPA, 1997d)

[128] Analyses were performed with matching laboratory bioassay data and chemical data from 989 samples collected in regions of the Atlantic, Pacific, and Gulf coasts. Data were gathered from results of amphipod survival tests (*Ampelisca abdita and Rhepoxynius abronius*) for all 989 samples. Data from a battery of sensitive bioassays (fertilization success of urchin gametes, embryological development of mollusc embryos, and microbial bioluminescence) were gathered for 358 of these samples. The percentages of samples indicating non-toxicity (not significantly different from controls, p > 0.05), significant toxicity (p < 0.05), and high toxicity (p < 0.05 and mean response >20 percent difference from controls) were determined for the results of the amphipod tests alone and for the results of any one of the tests performed.

34.2.4.2 Comparison of Cleanup Levels to Effects Range Lows (ERL) and Effects Range Medians (ERM)

The results in Table 34-4 reveal that the proposed sediment cleanup levels are below the ERL for zinc only, and between the ERL and ERM for arsenic, copper, lead, and PPAHs (compared to BAP only). The TBT ERL is exceeded, but TBT does not have an ERM value with which to compare the cleanup level. The only ERM exceeded by the cleanup level value is for PCBs, at 420 ug/kg versus the ERM of 180 ug/kg.

Table 34-5. Comparison of Cleanup Levels to ERLs and ERMs

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels	ERL	ERM
Arsenic	mg/kg	**10**	8.2	70.0
Copper	mg/kg	**200**	34.0	270.0
Lead	mg/kg	**90**	46.7	218.0
Mercury	mg/kg	**0.7**	0.15	0.7
Zinc	mg/kg	**90**	150	210
PPAHs	mg/kg	**0.7**	0.43 (1)	1.6 (1)
TBT	µg/kg	**20**	1.0	-
PCBs	µg/kg	**420**	22.7	180

(1) BAP values given, no Priority Pollutant PAHs value reported.

34.2.5 Theoretical Post Cleanup Human Health Risks

The Regional Board evaluated the potential human health risks posed by the residual chemical pollutant concentrations remaining in the sediment following remediation to the selected cleanup levels. This evaluation consisted of calculating theoretical post-cleanup cancer and non-cancer risks for recreational and subsistence anglers consuming fish from the Shipyard Sediment Site.

As discussed in the Tier II baseline risk assessment (Section 29), the chemical pollutants in fish (spotted sand bass) posing cancer risks at the Shipyard Sediment Site include inorganic arsenic and total polychlorinated biphenyls (PCBs) and the chemical pollutants posing non-cancer risks include mercury and total PCBs. The Regional Board focused only on total PCBs for this evaluation because, as summarized in Tables 34-6 and 34-7 below, total PCBs in whole body fish and fish fillet are the primary driver contributing to the overall cancer and non-cancer risks. Total PCBs in fillet sand bass contribute 75% - 95% of the cancer risks to recreational anglers and total PCBs in whole body fish contribute 96% - 99% of the cancer risks to subsistence anglers. Total PCBs in fillet sand bass contribute 100% of the non-cancer risks to recreational anglers and total PCBs in whole body fish contribute 94% - 98% of the non-cancer risks to subsistence anglers.

Table 34-6. Summary of Percent Contribution for Cancer Risk

Assessment Unit	Receptor	Diet	Carcinogenic Chemicals of Concern	Cancer Risk		
				Risk [1]	Risk Level	% Contribution [2]
Inside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	No	3.09×10^{-6}	Not Applicable
			PCBs	No	1.18×10^{-5}	Not Applicable
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	3.55×10^{-5}	1%
			PCBs	Yes	4.14×10^{-3}	99%
Outside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	3.86×10^{-6}	21%
			PCBs	Yes	1.47×10^{-5}	79%
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	5.32×10^{-5}	4%
			PCBs	Yes	1.18×10^{-3}	96%
Inside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	5.40×10^{-6}	5%
			PCBs	Yes	1.03×10^{-4}	95%
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	3.55×10^{-5}	1%
			PCBs	Yes	3.55×10^{-3}	99%
Outside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	Inorganic Arsenic	Yes	3.86×10^{-6}	12%
			PCBs	Yes	2.83×10^{-5}	88%
	Subsistence Angler	Whole Body Sand Bass	Inorganic Arsenic	Yes	4.73×10^{-5}	2%
			PCBs	Yes	1.91×10^{-3}	98%

[1] A cancer risk exists when the site risk is greater than 1x10-6 and greater than the risk calculated for the reference area. See Section 29 for details.
[2] Percent contribution for a chemical is determined by dividing the risk level for that chemical by the total risk.

Table 34-7. Summary of Percent Contribution for Non-Cancer Risk

Assessment Unit	Receptor	Diet	Carcinogenic Chemicals of Concern	Non-Cancer Risk		
				Risk [1]	Hazard Index	% Contribution [2]
Inside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	No	0.69	Not Applicable
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	4.1	2%
			PCBs	Yes	242	98%
Outside NASSCO Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	No	0.86	Not Applicable
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	4.60	6%
			PCBs	Yes	69	94%
Inside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	Yes	6.0	100%
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	3.9	2%
			PCBs	Yes	207	98%
Outside BAE Systems Leasehold	Recreational Angler	Fillet Sand Bass	PCBs	Yes	1.6	100%
	Subsistence Angler	Whole Body Sand Bass	Mercury	Yes	3.9	3%
			PCBs	Yes	112	97%

[1] A non-cancer risk exists when the site hazard index is greater than 1.0 and greater than the hazard index calculated for the reference area. See Section 29 for details.
[2] Percent contribution for a chemical is determined by dividing the hazard index for that chemical by the total hazard index.

The risk equations shown below were used to calculate the post-cleanup cancer and non-cancer risks. These equations were derived from Washington State Department of Ecology's report titled "Developing Health-Based Sediment Quality Criteria for Cleanup Sites: A Case Study Report" (WDOE, 1997).

For carcinogenic compounds,

R = (C*CPF*ED*IR*BSAF*FL) / (BW*AT*UCF)

For non-carcinogenic compounds,

HI = (C*IR*BSAF*FL) / (RfD*BW*UCF)

where:

R	=	Risk level (unitless)
HI	=	Hazard index (unitless)
C	=	Area weighted average sediment concentration (mg/kg)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
UCF	=	Unit conversion factor (grams/kg)
ED	=	Exposure duration (years)
IR	=	Ingestion rate (grams/day)
BSAF	=	Biota-sediment accumulation factor (unitless)
FL	=	Fish and shellfish lipid (decimal fraction)
CPF	=	Chemical-specific cancer potency factor $(mg/kg\text{-}day)^{-1}$
RfD	=	Chemical-specific reference dose (mg/kg-day)

The assumptions used by the Regional Board to estimate the post-cleanup risks at the Shipyard Sediment Site are shown below in Table 34-8 and the risk calculations using these assumptions are provided in the Appendix for Section 34.

Table 34-8. Assumptions for Post-Cleanup PCB Cancer and PCB Non-Cancer Risk Calculations

Parameter	Units	Recreational Angler	Subsistence Angler	Reference
C	mg/kg	0.22	0.22	WDOE 1997, NOAA 2005, U.S. EPA 1989a, U.S. EPA 1997b
BW	kg	70	70	WDOE 1997
AT	years	70	70	WDOE 1997
UCF	g/kg	1,000	1,000	WDOE 1997
ED	years	30	30	WDOE 1997
IR	g/day	21	161	OEHHA 2001, SCCWRP and MBC 1994
BSAF	unitless	1.65	1.84	Zeeman 2004
FL	unitless	0.003	0.017	Exponent 2003
CPF	$(mg/kg\text{-}day)^{-1}$	2	2	U.S. EPA 2003
RfD	(mg/kg-day)	0.00002	0.00002	U.S. EPA 2003

Based on the post-cleanup risk calculations and assumptions described above, the theoretical cancer and non-cancer risks from PCBs for the recreational angler consuming fish fillets are 2.80 x 10^{-7} and 0.016, respectively. The theoretical cancer and non-cancer risks from PCBs for the subsistence angler consuming whole body fish are 1.39 x 10^{-5} and 0.81, respectively. The U.S. EPA National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [129] states that acceptable exposure levels are generally concentration levels that represent an excess upper bound life-time cancer to an individual of between 10^{-4} and 10^{-6}. A hazard index less than 1.0 indicates that human exposure to chemical pollutant concentrations in fish and shellfish is below the level that is expected to result in a significant health risk.

[129] U. S. Code of Federal Regulations 40 CFR Part 300 National Oil And Hazardous Substances Pollution Contingency Plan, section 300.430(e) Feasibility study states:

> "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure."

These results are within the acceptable range of 10^{-4} and 10^{-6} and are below the hazard index threshold of 1.0. Therefore the selected PCB cleanup level presented above is judged to be protective of human health.

34.2.6 Comparison of Cleanup Levels to Screening Levels to Protect Wildlife

The Carlsbad U.S. Fish and Wildlife Office (CFWO) developed a process to identify bay-wide, risk-based screening levels for the sediment in San Diego Bay (Zeeman, 2004). The Regional Board, while recognizing a number of uncertainties associated with these calculations and assumptions, utilized this process to derive site-specific, risk-based sediment screening levels for the Shipyard Sediment Site. Details regarding the process and calculations are provided in the Appendix for Section 34. The results are provided below in Table 34-9 along with the alternative cleanup levels from Table 34-1.

Table 34-9. Comparison of the Alternative Cleanup Levels to Wildlife Risk-Based Sediment Screening Levels

Receptors	Primary Contaminant Drivers [1]	Risk-Based Sediment Screening Levels for Shipyard Sediment Site (mg/kg dry weight)		Risk-Based Sediment Screening levels for San Diego Bay [2] (mg/kg dry weight)		Alternative Cleanup Levels (mg/kg)
		Low TRV-based	High TRV-based	Low TRV-based	High TRV-based	
Brown Pelican	Lead	6.22	3,890	5.07	3,170	**90**
	Mercury	0.15	0.39	0.16	1.35	**0.7**
	Total PCB Aroclors	0.26	3.63	0.038	0.54	**--**
	Total PCB Congeners	0.18	2.53	0.019	0.27	**0.42**
Least Tern	Lead	2.0	1,250	1.65	1,031	**90**
	Zinc	402	4,020	157	1,565	**300**
	Total PCB Aroclors	0.08	1.18	0.013	0.18	**--**
	Total PCB Congeners	0.06	0.83	0.006	0.09	**0.42**
Sea Lion	NONE	--	--	--	--	**--**
Surf Scoter	Copper	184	4,180	101	2,298	**200**
	Lead	2.05	1,280	1.3	821	**90**
	Benzo[a]pyrene	See Footnote 3	See Footnote 3	See Footnote 3	See Footnote 3	**1.0**
Western Grebe	Lead	3.26	2,040	2.95	1,841	**90**
	Total PCB Aroclors	0.28	3.94	0.042	0.59	**--**
	Total PCB Congeners	0.20	2.75	0.021	0.29	**0.42**
Green Turtle	Lead	8.48	5,300	18.2	11,347	**90**

[1] The primary contaminant driver(s) listed for each receptor of concern are those identified in Section 25.
[2] Risk-based screening levels developed by CFWO (Zeeman, 2004).
[3] Risk-based screening levels for benzo[a]pyrene (BAP) could not be calculated because there are no BAP toxicity reference values available for birds.

The TRVs are presented as an upper and lower estimate of effects thresholds. The low-TRV is based on no-adverse-effects-levels (NOAELs) and represents a threshold below which no adverse effects are expected. The high-TRV is based on an approximate midpoint of the range of effects levels and represents a threshold above which adverse effects are likely to occur. Conversely, adverse effects are not likely to occur when concentrations are below the high-TRV values. See Section 25 and the Appendix for Section 34 for more discussion of TRVs and risk assessment for aquatic-dependent wildlife.

Based on the comparison of the alternative cleanup levels to the low TRV-based and high TRV-based screening levels calculated for the Shipyard Sediment Site and for San Diego Bay (Table 34-9), it is judged that the cleanup levels are reasonably protective of aquatic-dependent wildlife. The alternative cleanup levels for all of the primary contaminant drivers, with the exception of mercury, are either below the low TRV-based screening levels or between the low TRV-based and high TRV-based screening levels calculated for the Shipyard Sediment Site. Additionally, the alternative cleanup levels for all of the primary contaminant drivers, with the exception of total PCB congeners, are between the low TRV-based and high TRV-based screening levels calculated for San Diego Bay. Below is a summary of the comparisons:

- Copper is identified as a primary contaminant driver for the surf scoter. The alternative cleanup level for copper is between both the low TRV and high TRV screening values calculated for the Shipyard Sediment Site and for San Diego Bay.
- Lead is identified as a primary contaminant driver for all receptors of concern (excluding the sea lion). The alternative cleanup level for lead is between both the low TRV and high TRV screening values calculated for the Shipyard Sediment Site and for San Diego Bay.
- Mercury is identified as a primary contaminant driver for the brown pelican. The alternative cleanup level for mercury is above the high TRV screening value calculated for the Shipyard Sediment Site and is between the San Diego Bay low TRV and high TRV screening values.
- Zinc is identified as primary contaminant drivers for the least tern. The alternative cleanup levels for zinc is below the low TRV screening value calculated for the Shipyard Sediment Site and between the San Diego Bay low TRV and high TRV screening values.
- Total PCB congeners are identified as a primary contaminant driver for the brown pelican, least tern, and the western grebe. The alternative cleanup level for total PCB congeners is between the low TRV and high TRV screening values calculated for the Shipyard Sediment Site and is above the high TRV screening value for San Diego Bay.

35. Finding 35: Legal and Regulatory Authority

This Order is based on (1) section 13267 and Chapter 5, Enforcement, of the Porter-Cologne Water Quality Control Act (Division 7 of the Water Code, commencing with section 13000), commencing with section 13300; (2) applicable state and federal regulations; (3) all applicable provisions of statewide Water Quality Control Plans adopted by the State Water Resources Control Board and the *Water Quality Control Plan for the San Diego Basin* (Basin Plan) adopted by the Regional Board including beneficial uses, water quality objectives, and implementation plans; (4) State Water Board policies for water quality control, including State Water Board Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in California*) and Resolution No. 92-49 (*Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304*); and (5) relevant standards, criteria, and advisories adopted by other state and federal agencies.

35.1 Porter-Cologne Water Quality Control Act Jurisdiction

The Porter-Cologne Water Quality Control Act (Division 7 of the Water Code, commencing with section 13000) is replete with provisions intended to protect beneficial uses from impacts from contaminated sediment. Porter-Cologne jurisdiction extends beyond water column effects to require the reasonable protection of beneficial uses from discharges of waste to waters of the state. Legislative history of the Porter-Cologne Act states in commentary on the definition of "pollution" that "it is the unreasonable effect upon beneficial uses of water, caused by waste, that constitutes pollution."[130] This history expresses the intent that if a person discharges waste into waters of the state and beneficial uses of the water are thereby harmed - then pollution exists even if water column concentrations are not effected by wastes that have settled in sediment.

35.1.1 Water Code Section 13267

Water Code section 13267 provides that the Regional Board can require any person who has discharged, discharges, proposes to discharge or is suspected of discharging waste to investigate, monitor, and report information. The only restriction is that the burden of preparing the reports bears a reasonable relationship to the need for and the benefits to be obtained from the reports.

[130] Final Report of the Study Panel to the California State Water Resources Control Board, 1969, p. 30.

35.1.2 Water Code Section 13304

Water Code section 13304 contains the cleanup and abatement authority of the Regional Board. Section 13304(a) provides that any person who has discharged or discharges waste[131] into waters of the state in violation of any waste discharge requirement[132] or other order or prohibition issued by a Regional Water Board or the State Water Board or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution[133] or nuisance[134] may be required to clean up the discharge and abate the effects thereof. This Section authorizes Regional Water Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

35.2 Applicable Federal Regulations

U.S. EPA promulgated a final rule prescribing water quality criteria for toxic pollutants in inland surface waters, enclosed bays, and estuaries in California in 2000 (The California Toxics Rule or "CTR;".[135] CTR criteria constitute applicable water quality objectives in California. In addition to the CTR, certain criteria for toxic pollutants in the National Toxics Rule (NTR) [40 CFR 131.36] constitute applicable water quality objectives in California as well.

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[131] "Waste" is very broadly defined in Water Code section 13050(d) and includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal.

[132] The term waste discharge requirements include those, which implement the National Pollutant Discharge Elimination System.

[133] Pollution" is defined in Water Code section 13050 (1) as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following: (A) the waters for beneficial uses, (B) Facilities which serve these beneficial uses." Pollution" may include "contamination.."

[134] Nuisance is defined in Water Code section 13050(m) "…. anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes."

[135] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

35.3 Water Quality Control Plan for the San Diego Basin (Basin Plan)

The Regional Board's Water Quality Control Plan for the San Diego Basin (Basin Plan) designates 12 beneficial uses[136] for San Diego Bay[137] that may be adversely affected by contaminated sediment. These beneficial uses fall into four broad categories as shown below:

AQUATIC LIFE BENEFICAL USES	AQUATIC - DEPENDENT WILDLIFE BENEFICAL USES	HUMAN HEALTH BENEFICIAL USE	NAVIGATION AND SHIPPING BENEFICICAL USES
Estuarine Habitat (EST)	Wildlife Habitat (WILD)	Contact Water Recreation (REC1)	Navigation (NAV)
Marine Habitat (MAR)	Preservation of Biological Habitats of Special Significance (BIOL)	Non Contact Water Recreation (REC2)	
Migration of Aquatic Organisms (MIGR)	Rare, Threatened or Endangered Species (RARE)	Shellfish Harvesting (SHELL)	
Preservation of Biological Habitats of Special Significance (BIOL)		Commercial and Sport Fishing (COMM)	

The Basin Plan also contains a narrative water quality objective[138] for toxicity[139] applicable to San Diego Bay as follows:

[136] See Water Code section 13050(f). "Beneficial uses" of the waters of the state that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

[137] Basin Plan, Table 2-3, Beneficial Uses of Coastal Waters at page 2-47. Specific definitions of the beneficial uses are provided in the Basin Plan at pages 2-3 and 2-4.

[138] "Water quality objectives" are defined in Water Code section 13050(h) as "the limits or levels water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

[139] Basin Plan, Chapter 3. Water Quality Objectives, Page 3-15.

> *"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."*
>
> *"The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with requirements specified in US EPA, State Water Resources Control Board or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute bioassay."*
>
> *"In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged."*

35.4 Resolution No. 92-49

State Water Resources Control Board Resolution No. 92-49, (*Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304*) describes the policies and procedures that apply to the cleanup and abatement of all types of discharges subject to Water Code section 13304 (SWRCB, 1996). These include discharges, or threatened discharges, to surface and groundwater. The Resolution requires dischargers to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality or the best water quality that is reasonable if background levels of water quality cannot be restored, considering economic and other factors. In approving any alternative cleanup levels less stringent than background, Regional Boards must apply section 2550.4 of Title 23 of the California Code of Regulations.[140] Section 2550.4 provides that a regional board can only approve cleanup levels less stringent than background if the Regional Board finds that it is technologically or economically infeasible to achieve background. Resolution No. 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards[141] result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

[140] Resolution No. 92-49, Section III.G.

[141] *Id.*

Resolution No. 92-49 is applicable to establishing cleanup levels at the Shipyard Sediment Site. The State Water Resources Control Board's Office of Chief Counsel (hereinafter Office of Chief Counsel) fully supports this position. A Regional Board must apply Resolution No. 92-49 when setting cleanup levels for contaminated sediment if such sediment threatens beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. Contaminated sediment must be cleaned up to background sediment quality unless it would be technologically or economically infeasible to do so (Wilson, 2002).

35.5 Resolution No. 68-16

SWRCB Resolution No. 92-49 specifies that cleanup and abatement actions must conform to Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California* (SWRCB, 1968). SWRCB Resolution No. 68-16 is a state policy that establishes the requirement that discharges to waters of the state shall be regulated to achieve "the highest water quality with maximum benefit to the people of the State." Resolution No. 68-16 also establishes the intent where the waters of the State are of higher quality than required by state policies, including Water Quality Control Plans, such higher "shall be maintained to the maximum extent possible" consistent with the maximum benefit to the people of the State.

35.6 Policy for Implementation of Toxics Standards

The State Water Board Policy for Implementation of Toxics Standards (the SIP) provides that mixing zones shall not result in "objectionable bottom deposits" (SWRCB, 2005). This term is defined as "an accumulation of materials … on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediment (SIP at Appendix 4).

36. Finding 36: CEQA Exemption

This enforcement action is exempt from the provisions of the California Environmental Quality Act (CEQA) because it falls within Classes 7, 8, and 21 of the categorical exemptions for projects that have been determined not to have a significant effect on the environment under section 21084 of CEQA. [14 CCR 15307, 15308, and 15321.] The Regional Board will not undertake any construction activity as a result of this Order, nor will the issuance of this Order allow environmental degradation.

36.1 CEQA Exemption

Issuance of a Cleanup and Abatement Order (CAO) pursuant to Section 13304 of the Water Code is exempt from the California Environmental Quality Act (Division 13, commencing with Section 21000, of the Public Resources Code, CEQA) because the issuance of a CAO falls within several of the categorical exemptions for projects that have been determined not to have a significant effect on the environment.

The Secretary of the California Resources Agency is required to promulgate guidelines for implementation of CEQA, including "a list of classes of projects which have been determined not to have a significant effect on the environment and which shall be exempt from [CEQA]. In adopting the guidelines, the Secretary of the Resources Agency shall make a finding that the listed classes of projects referred to in this section do not have a significant effect on the environment."[142] The guidelines are located in Title 14 of the California Code of Regulations (CCR), at section 15000, *et seq*. Chapter 3, Article 3, commencing with section 15300, lists the classes of projects that have been determined not to have a significant effect on the environment and are exempt from CEQA under section 21084 of CEQA.

<u>Actions by Regulatory Agencies for Protection of Natural Resources</u>
"Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment."[143]

<u>Actions by Regulatory Agencies for Protection of the Environment</u>
"Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment."[144]

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[142] [Public Resources Code sections 21083, 21084.]

[143] [14 CCR 15307.]

[144] [14 CCR 15308.]

Enforcement Actions by Regulatory Agencies

Class 21 includes "actions by regulatory agencies to enforce or revoke a lease, permit, license, certificate, or other entitlement for use issued, adopted, or prescribed by the regulatory agency or **enforcement of a law, general rule, standard, or objective, administered or adopted by the regulatory agency**. Such actions include, but are not limited to, the following[145]:

…

(2) The adoption of an administrative decision or order … enforcing the general rule, standard, or objective."

Neither construction activities undertaken by the regulatory agency nor relaxation of standards allowing environmental degradation are included in any of these exemptions.

The Regional Board's regulatory action of issuing a cleanup and abatement order to restore the water quality necessary to support beneficial uses of the water resources of the state and to abate existing or threatened pollution under Water Code section 13304 falls under the classes of projects defined by sections 15307, 15308, and 15321(a) of the CEQA guidelines and is therefore categorically exempt from CEQA.[146] The Regional Board will not be undertaking any construction activities as a result of the issuance of the CAO requiring cleanup of wastes discharged to sediments in or around San Diego Bay shipyards. Any construction activity proposed by persons subject to the CAO will be subject to project-specific regulation that may entail separate environmental impact assessment and documentation under CEQA.

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[145] [14 CCR 15321(a), emphasis added.]

[146] [14 CCR 15307, 15308, 15321.]

37. Finding 37: Public Notice

The Regional Board has notified all known interested persons and the public of its intent to adopt this Cleanup and Abatement Order and has provided them with an opportunity to submit written comments and recommendations.

37.1 Public Notice

Prior to the issuance of a final cleanup and abatement order in this matter, the Regional Board will first provide an opportunity for all Parties and interested persons[147] to review technical information in the files of the Regional Board and comment on issues pertaining to the proposed cleanup and abatement order and to respond to evidence, documents, and comments submitted by other Parties and interested persons. All technical evidence and documentation that Parties and interested persons would like the Regional Board to consider must be submitted to the Regional Board in writing during this period. The Regional Board will hold public hearings on this matter once all written submittals have been made. The purpose of the public hearings is for the Regional Board to receive final comments from Parties and interested persons and to ask questions regarding written submittals.

The Regional Board's consideration of testimony and written submittals by Parties and interested persons may result in revisions to the current version of tentative Cleanup and Abatement Order No. R9-2005-0126 during the course of the proceedings. Thus the finalized version of the tentative Cleanup and Abatement Order that is ultimately considered for adoption by the Regional Board at the conclusion of the proceedings may differ markedly from the initial tentative version of the Cleanup and Abatement Order issued on April 29, 2005.

The Regional Board held pre-hearing conferences on September 26, 2005 and December 6, 2005, and issued a First Amended Order of Proceedings dated January 30, 2006, to establish procedures to ensure an orderly, efficient, and impartial administrative process for the development of an appropriate Cleanup and Abatement Order and to provide a fair opportunity for all Parties and interested persons to fully participate in the proceedings.

[147] "Parties" to the proceeding include the persons to whom the tentative cleanup and abatement order is directed, and any other person whom the Regional Board determines should be designated as a party. "Person" includes an individual, partnership, corporation, governmental subdivision or units of a governmental subdivision, or public or private organization or entity of any character.

38. Finding 38: Public Hearing

The Regional Board has considered all comments pertaining to this Cleanup and Abatement Order submitted to the Regional Board in writing, or by oral presentations at the public hearing held on [date(s) to be inserted]. Detailed responses to relevant comments ~~has~~ have been incorporated into the final Technical Report for the Cleanup and Abatement Order adopted by this Order.

38.1 Public Hearing

See discussion in Section 37 of this Technical Report on the public participation process.

39. Order Directives

IT IS HEREBY ORDERED *that, pursuant to sections 13267 and 13304 of the Water Code, National Steel and Shipbuilding Company;* *BAE Systems* San Diego Ship Repair Inc. *(formerly* Southwest Marine*, Inc.); City of San Diego; Marine Construction and Design Company and Campbell Industries, Inc; Chevron, a subsidiary of ChevronTexaco; BP; San Diego Gas and Electric, a subsidiary of Sempra Energy Company; and the United States Navy (hereinafter Discharger(s)), shall comply with the following directives:*

A. CLEANUP AND ABATE

1. The Discharger(s) shall take all corrective actions[148] necessary to cleanup contaminated marine bay sediment at the Shipyard Sediment Site to attain the sediment quality levels specified below:

Chemical	Units (dry weight)	Sediment Quality Levels
Metals		
Arsenic	mg/kg	10
Cadmium	mg/kg	1.0
Chromium	mg/kg	81
Copper	mg/kg	200
Lead	mg/kg	90
Mercury	mg/kg	0.7
Nickel	mg/kg	20
Silver	mg/kg	1.5
Zinc	mg/kg	300
Organics		
Tributyltin	μg/kg	110
Benzo[a]pyrene	μg/kg	1,010
Total PCB Congeners [1]	μg/kg	420

[1] PCB = polychlorinated biphenyl

[148] Corrective Actions include the phases of cleanup and abatement described in Directives A through D of this Cleanup and Abatement order.

B. REMEDIAL ACTION PLAN AND IMPLEMENTATION

1. ***Remedial Action Plan (RAP)***. The Discharger(s) shall submit a Remedial Action Plan (RAP) to the Regional Board by [date based on 90 days after adoption to be inserted]. The RAP shall contain the following information:

    a. Implementation Activities. A detailed description of all activities planned to implement the corrective actions necessary to comply with all the directives herein;

    b. Shipyard Sediment Site Map. A map(s), using an appropriate modeling program, illustrating the horizontal and vertical distribution of pollutants within the remediation area defined by the sediment quality cleanup levels described in Directive A.1;

    c. Schedule. A schedule detailing the sequence of events and time frame for each activity; and

    d. Short-Term Effectiveness Monitoring Activities. A monitoring program as described in Directive C, Cleanup and Abatement Verification, to demonstrate the effectiveness of the RAP. The monitoring program shall be effective in determining compliance with the cleanup levels and in determining the success of the remedial action measures.

2. ***Remedial Action Plan (RAP) Implementation***. In the interest of promoting prompt cleanup, the Discharger(s) may begin implementation of the RAP sixty (60) calendar days after submittal to the Regional Board, unless otherwise directed in writing by the Regional Board. Before beginning RAP implementation activities, the Discharger(s) shall:

    a. Notify the Regional Board of its intention to begin cleanup; and

    b. Comply with any conditions set by the Regional Board, including mitigation of adverse consequences from cleanup activities.

3. ***Remedial Action Zone***. The Discharger(s) shall implement remedial action measures that ensure that marine sediment pollutants attain their respective cleanup levels at all monitoring points and throughout the Shipyard Sediment Site.

4. ***Implementation Schedule***. Implementation of the RAP shall be completed on a schedule to be established by the Regional Board in a subsequent amendment to this Cleanup and Abatement Order.

5. ***Monitoring, Evaluation, and Reporting***. The Discharger(s) shall monitor, evaluate, and report the results of implementation of the RAP on a schedule to be established by the Regional Board in a subsequent amendment to this Cleanup and Abatement Order.

6. ***Modify or Suspend Cleanup Activities***. The Discharger(s) shall modify or suspend cleanup activities when directed to do so by the Regional Board.

C. CLEANUP AND ABATEMENT COMPLETION VERIFICATION

1. ***Cleanup and Abatement Completion Report***. The Discharger(s) shall submit a final Cleanup and Abatement Completion Report verifying completion of the Remedial Action Plan (RAP) for the Shipyard Sediment Site. The report shall provide a demonstration, based on a sound technical analysis that marine sediment quality cleanup levels specified in Directive A.1. for all pollutants are attained at all monitoring points and throughout the Shipyard Sediment Site.

D. POST CLEANUP MONITORING

1. ***Post Cleanup Monitoring Plan***. The Discharger(s) shall submit a Post Cleanup Monitoring Plan to the Regional Board by [Insert Date]. The Post Cleanup Monitoring Plan shall be designed to confirm the short-term and long-term effectiveness of the cleanup. The Post Cleanup Monitoring Plan shall contain the following information:

   a. *Monitoring Activities.* A detailed description of monitoring and sampling activities designed to assess the site conditions, including the benthic community health, after the RAP is completed. The monitoring activities shall include sampling for a period of not less than five years; and

   b. *Schedule*. A schedule detailing the sequence of events and time frame for each activity. The schedule shall also include the dates for submittal of the Post-Cleanup Monitoring annual progress reports and final report as detailed in Section D.2. below.

2. ***Post Cleanup Monitoring Report***. The Discharger shall submit annual progress reports and a final Post Cleanup Monitoring Report, on a schedule to be established by the Regional Board in a subsequent amendment to this Cleanup and Abatement Order, containing the following information:

   a. *Monitoring Activities* – A detailed description of the post cleanup monitoring activities performed; and

   b. *Interpretations and Conclusions.* Interpretations and conclusions regarding the potential presence and chemical characteristics of any newly deposited sediment within the cleanup areas, and interpretations and conclusions regarding the health and recovery of the benthic communities.

E. REGIONAL BOARD CONCURRENCE

1. ***Regional Board Concurrence***. Upon concurrence with the findings of the Cleanup and Abatement Completion Report (Directive C.1) and the Post Cleanup Monitoring Report (Directive D.2) that remedial actions and monitoring are complete and that compliance with this Cleanup and Abatement Order is achieved, the Regional Board will inform the Discharger(s) and other interested persons in writing that no further remedial work is required at this time, based on available information. This written notice shall constitute Regional Board concurrence with the completed remedial actions.

F. PROVISIONS

1. ***Cost Recovery***. The Discharger(s) shall reimburse the State of California for all reasonable costs actually incurred by the Regional Board to investigate, oversee, and monitor cleanup and abatement actions required by this Cleanup and Abatement Order, according to billing statements prepared from time to time by the State Water Resources Control Board. If the Discharger(s) is enrolled in a reimbursement program managed by the State Water Resources Control Board for the discharge addressed by this Cleanup and Abatement Order, reimbursement shall be made pursuant to the procedures established in that program.
2. ***Waste Management***. The Discharger(s) shall properly manage, store, treat, and dispose of contaminated soils and ground water in accordance with applicable federal, state, and local laws and regulations. The storage, handling, treatment, or disposal of contaminated marine sediment and associated waste shall not create conditions of pollution, contamination or nuisance as defined in Water Code section 13050. The Discharger(s) shall, as required by the Regional Board, obtain, or apply for coverage under, waste discharge requirements or a conditional waiver of waste discharge requirements for the removal of waste from the immediate place of release and discharge of the waste to (a) land for treatment, storage, or disposal or (b) waters of the state.
3. ***Request to Provide Information***. The Discharger(s) may present characterization data, preliminary interpretations and conclusions as they become available, rather than waiting until a final report is prepared. This type of on-going reporting can facilitate a consensus being reached between the Discharger(s) and the Regional Board and may result in overall reduction of the time necessary for regulatory approval.

4. ***Waste Constituent Analysis***. Unless otherwise permitted by the Regional Board, all analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services. Specific methods of analysis must be identified. If the Discharger(s) proposes to use methods or test procedures other than those included in the most current version of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846" (U.S. Environmental Protection Agency) or 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants; Procedures for Detection and Quantification ", the exact methodology must be submitted for review and must be approved by the Regional Board prior to use. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports submitted to the Regional Board.

5. ***Duty to Operate and Maintain***. The Discharger(s) shall, at all times, properly operate and maintain all facilities and systems of treatment, control, storage, disposal and monitoring (and related appurtenances) which are installed or used by the Discharger(s) to achieve compliance with this Cleanup and Abatement Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities, which are installed by the Discharger(s) only when the operation is necessary to achieve compliance the conditions of this Cleanup and Abatement Order.

6. ***Duty to Use Registered Professionals***. The Discharger(s) shall provide documentation that plans and reports required under this Cleanup and Abatement Order are prepared under the direction of appropriately qualified professionals. California Business and Professions Code sections 6735, 7835 and 7835.1 require that engineering and geologic evaluations and judgments be performed by or under the direction of registered professionals. A statement of qualifications and registration numbers of the responsible lead professionals shall be included in all plans and reports submitted by the Discharger(s). The lead professional shall sign and affix their registration stamp to the report, plan or document.

7. ***Corporate Signatory Requirements***. All reports required under this Order shall be signed and certified by a responsible corporate officer(s) of the Discharger(s) described in paragraph 5.a. of this provision or by a duly authorized representative of that person as described in paragraph 5.b.of this provision.

   a. *Responsible Corporate Officer(s).* For the purposes of this provision, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy - or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b. *Duly Authorized Representative*. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a) of this provision;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Regional Board.

c. *Changes to Authorization*. If an authorization under paragraph (b) of this provision is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this provision must be submitted to the Regional Board prior to or together with any reports or information to be signed by an authorized representative.

d. *Certification Statement*. Any person signing a document under paragraph a. or b. of this provision shall make the following certification:

”I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

8. ***Duty to Submit Other Information***. When the Discharger(s) becomes aware that it failed to submit any relevant facts in any report required under this Cleanup and Abatement Order, or submitted incorrect information in any such report, the Discharger(s) shall promptly submit such facts or information to the Regional Board.

9. ***Electronic and Paper Media Reporting Requirements***. The Discharger(s) shall submit both electronic and paper copies of all reports required under this Cleanup and Abatement Order including work plans, technical reports, and monitoring reports.

10. ***Report Submittals***. All monitoring and technical reports required under this Cleanup and Abatement Order shall be submitted to:

    Executive Officer
    California Regional Water Quality Control Board
    San Diego Region
    9174 Sky Park Court, Suite 100
    San Diego, CA 92123-4340

11. ***Identify Documents Using Code Number***. In order to assist the Regional Board in the processing of correspondence and reports submitted in compliance with this Cleanup and Abatement Order, the Discharger(s) shall include the following code number in the header or subject line portion of all correspondence or reports submitted to the Regional Board:

    For all correspondences: Shipyards CAO: 03-0284.05
    For all reports: Shipyards CAO: 03-0284.051

G. NOTIFICATIONS

1. ***Enforcement Discretion***. The Regional Board reserves its right to take any enforcement action authorized by law for violations of the terms and conditions of this Cleanup and Abatement Order.
2. ***Enforcement Notification***. The Porter-Cologne Water Quality Control Act commencing with Chapter 5, Enforcement and Implementation, section 13308, provides that if there is a threatened or continuing violation of a cleanup and abatement order, the Regional Board may issue a Time Schedule Order prescribing a civil penalty in an amount not to exceed $10,000 per day for each day compliance is not achieved in accordance with that time schedule. Section 13350 provides that any person may be assessed administrative civil liability by the Regional Board for violating a cleanup and abatement order in an amount not to exceed $5,000 for each day the violation occurs, or on a per gallon basis, not to exceed $10 for each gallon of waste discharged. Alternatively the court may impose civil liability in an amount not to exceed $15,000 for each day the violation occurs, or on a per gallon basis, not to exceed $20 for each gallon of waste discharged. Section 13385 provides that any person may be assessed administrative civil liability by the Regional Board for violating a cleanup and abatement order for an activity subject to regulation under Division 7, Chapter 5.5 of the Water Code, in an amount not to exceed the sum of both of the following: (1) $10,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $10 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons. Alternatively the civil liability may be imposed by the court in an amount not to

exceed the sum of both of the following: (1) $25,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $25 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons.

I, John H. Robertus, Executive Officer, do hereby certify the forgoing is a full, true, and correct copy of a Cleanup and Abatement Order issued on [Insert Date].

John H. Robertus
Executive Officer

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